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ABSTRACT

In 1992, the U.S. Department of Education awarded three-year grants to five states and the District of Columbia for the development of curriculum frameworks in mathematics or science for grades K-12 together with new approaches to teacher education, certification, and professional development. This final report on the Dwight D. Eisenhower State Curriculum Frameworks Projects uses the findings from the evaluation of the 16 projects to better understand the implementation of standards-based reform at the state and district levels. Chapters include: (1) "Introduction"; (2) "Progress of the Projects"; (3) "Developing Frameworks and Other Products: Strategies and Issues"; (4) "Quality: A Review of Mathematics and Science Curriculum Frameworks"; (5) "Curriculum Frameworks and State Policy"; (6) "Implementation Strategies for Improving Teacher Practice"; (7) "Impact in the Districts"; and (8) "Conclusions." Appendices include a document list, a list of reviewers and procedures, and state examples. Contains 19 references. (ASK)

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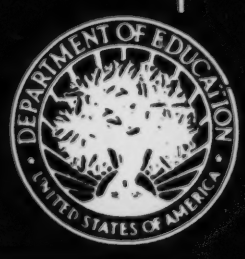

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Eisenhower Mathematics and Science State Curriculum Frameworks Projects: Final Evaluation Report

1997

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EXECUTIVE SUMMARY

In 1992, the U.S. Department of Education (ED) awarded 3-year grants to five states and the District of Columbia for the development of curriculum frameworks in mathematics or science for grades K-12, together with new approaches to teacher education, certification, and professional development. These grants averaged about $850,000 and ran through September 30, 1995. In 1993, ED awarded 3-year grants to 10 additional states.

As part of a federal strategy to promote systemic, standards-based reform, curriculum frameworks were intended to play a central role in translating the national standards to state policy-makers, district officials, and local educators. In the original solicitation, curriculum frameworks were defined as "guidelines for the content of the curriculum and for how that content should be organized." The projects were also charged with the development of "other products," specifically:

- Develop model guidelines for effective approaches to teacher education and certification based upon world class standards and the State curriculum frameworks tied to those standards; and
- Develop criteria for teacher recertification, and design and pilot test a model, cost-effective inservice professional development program for teachers based upon world class standards and the State curriculum frameworks tied to those standards. [*Federal Register*, *57*(146), July 29, 1992, pp. 33603-33604]

This final report on the Dwight D. Eisenhower State Curriculum Frameworks Projects uses the findings from the evaluation of the 16 projects to better understand the implementation of standards-based reform at the state and district levels.

Progress of the Projects

Although there was wide variation in the format and quality of the documents that the project states produced, 15 of the 16 states completed curriculum frameworks as a result of their grants. One state, Arizona, halted work on the project before completing a framework. Regardless of the progress of the projects, all 16 states that received curriculum framework grants were actively engaged in standards-based reform. Even in those states where the framework projects ran into difficulty, state officials and policy-makers were reviewing and revising policies and programs under the banner of standards.

However, the 16 projects devoted less time and resources to the project's other products: model guidelines for teacher education and certification, criteria for teacher recertification, and model professional development. As a result, the projects were unable to meet the full expectations of the original solicitation. Those states that were best able to claim some progress did so as a result of activities already under way in the state. This progress can be summarized as follows:

- Only Delaware, Michigan, New York, and Oregon formally designed, piloted, and evaluated model professional development programs, although most states did conduct framework-based professional development as an implementation strategy.
- Eight of the framework projects claimed progress toward drafting guidelines for teacher education and certification.
- Eight states reported changes in teacher recertification policies.

Given that 48 states have developed or are developing standards documents in core discipline areas, it seems likely that the 16 states that received Eisenhower State Curriculum Frameworks Project grants would have developed curriculum frameworks or other standards documents without the grants. However, the grants brought resources that enriched the framework development process. Federal funds allowed project states more resources and therefore more time, professional staffing, and opportunities for professional development than was the case in most non-project states.

Even though the states' progress on the other products was uneven, a case can be made that federal funds did help those states that tried to develop model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification. However, on the face of it, the value added by this investment seems to be significantly lower than that of the investment in development of frameworks.

The grants did not guarantee a high-quality or even a completed document or product, but every state official involved in the projects can point to a positive contribution of the grant. Despite similar ranges of quality among project and non-project states, project states, in general, produced more comprehensive documents. Just how lasting the contributions of the framework documents will be remains an open question.

Developing Frameworks and Other Products: Strategies and Issues

The typical framework project followed a development process that had the following characteristics:

- The development process was typically organized through the state department of education.
- Committees comprised of university scholars, discipline specialists, teachers, administrators, and occasionally business and community representatives were charged with developing the curriculum frameworks.
- The actual writing of the document was done by a subcommittee, which brought successive drafts to the full committee for review and comment.
- Typically, the development process began by reviewing national standards (NCTM, *Benchmarks*, and the National Science Education Standards), but the committees viewed these documents as sources of ideas and guides, not as something to be strictly followed.

Framework development strategies varied among states, but all were affected by the political context, either in initial choices about the projects or by midcourse corrections necessary to develop documents that were relevant to local educators and acceptable to state leaders. The project states were careful to avoid public controversy, thereby creating a tension between consensus building and reform. Thus, the state departments (and state boards in some states) faced the challenge of promoting change while avoiding discord. This delicate balance required the use of language that the public understood in order to reduce the chances of a negative reaction, but risked getting no reaction, thereby weakening support for reform. One result was that standards and framework development became a professional, not a public, activity. However, obtaining public support for standards is likely to require varied educational opportunities, primarily at the local level, for the many publics to more fully understand standards and their implications.

The projects used a variety of strategies in the development of model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification. These included:

- Drafting a document or a framework chapter that discusses or recommends particular courses of action in these areas of policy and practice.
- Implementing a set of activities, usually framework-based workshops.
- Working with or handing off to an existing task force or project the responsibility for addressing one of these issue areas.

- Choosing not to address particularly difficult issues.

The projects' uneven progress on the other products was a result of the unrealistic assumptions of the original solicitation and the projects' emphasis on framework development over work on the other products. In the future, ED might consider avoiding such multifaceted and complex awards. Alternatively, if ED targeted specific activities in multiple awards and required that the projects coordinate their efforts, or gave clear direction as to the level of effort expected on each facet of the grant, the states would be better able to complete all components of the project.

Finally, the State Curriculum Frameworks Projects revealed a problem with ED's financial management and monitoring systems. A new financial management system may improve the situation, but ED still faces the challenge of improving its monitoring system.

Quality of the Curriculum Frameworks

The study team convened a group of 18 distinguished mathematics and science educators. This group of reviewers developed a rubric for assessing the quality of framework documents and, using this rubric, assessed 12 framework documents. The major findings from this analysis are:

- In general, the reviewers found that state frameworks showed marked progress in expanding beyond a basic-skills emphasis to focus more on higher-order skills for all students in mathematics and science.
- At the same time, the reviewers found that some of the frameworks omitted some of the major categories of the national standards, suffered from a lack of usability, or failed to convey adequately how equity can be achieved.
- Most frameworks presented sample activities and vignettes that often were either inconsistent with national standards or inadequately annotated and explained.
- Frameworks tended to address classroom assessment, but not large-scale assessment. Many framework documents contained performance indicators for the classroom; however, few contained rubrics for evaluating levels of performance.

Following the experts' analysis, our study collected 10 local curriculum documents from 5 states and examined their alignment with the state frameworks. Some local documents were more explicitly aligned with the state frameworks than others. In a few cases, the local documents seemed not to reflect the state frameworks. High-quality state

curriculum frameworks appear to help districts produce high-quality local curriculum frameworks or guides; however, they do not guarantee quality.

Curriculum Frameworks and State Policy

The State Curriculum Frameworks Projects corresponded with a period of active policy development in the states. Besides developing framework or standards documents, the states began developing and piloting new assessment systems, addressing the issue of teacher licensure, and reconsidering a host of other policies. States that received grants were already trying to implement reform, but in the vast majority of these states the framework projects were a resource for policy reform. Specifically:

- All but one of the 16 project states were planning, developing, piloting, or implementing new statewide assessment systems.
- In 10 of the 16 states, the projects' frameworks played a central role in the assessment development process.
- Nine of the 16 project states were developing new certification and/or new recertification requirements, had them under consideration by the appropriate policy-making body, or had them in place.
- Six of those states used the frameworks in the development of new teacher licensure requirements.

The glass is more than half full when it comes to the frameworks' influence on state policy, although two factors tended to limit that influence:

- As the name implies, the State Curriculum Frameworks Projects were viewed by some state officials as projects, just like hundreds of other projects they oversaw.
- Even in states where project leadership thought of the project as part of a grand scheme for changing policy, there was no systematic plan for changing policy.

Despite these limitations, the majority of frameworks developed through the projects were a useful resource in the states' efforts to make education policy align with the goal of high standards for all students.

Implementation Strategies for Improving Teacher Practice

The State Curriculum Frameworks Projects employed a variety of strategies to use the frameworks to help improve teacher practice:

- Thirteen of the 16 states used professional development and technical assistance to increase teacher understanding and use of the frameworks.

- Six states produced resource guides or other support materials to supplement the frameworks.
- Fourteen of the 16 states used technology to increase access and awareness of the frameworks.
- Six states used pilot sites to serve as examples for other sites trying to use the frameworks.
- Two states sponsored study groups for teachers to read and discuss the frameworks.

Not all of these professional development opportunities were paid for with project funds, as the states made efforts to leverage resources to support the implementation process. The types of opportunities states offered varied across and within states on a number of dimensions, including content, intensity, and duration.

The most ambitious projects maximized teachers' exposure to the documents and provided both time and resources for teachers to study, reflect, and experiment. These strategies required a coordinated effort—one that garnered the resources of other state, federal, and local reform efforts. It also required that implementation strategies extend beyond the life of the grants.

Impact in the Districts

We visited 17 local districts in 8 states and highlight 5 cases in this report. Local districts used frameworks to revise their local curriculum guides and to improve teacher practice with varying degrees of success. However, the cases illustrate that professional practice can improve when teachers and others are involved in production of local standards. The cases also illustrate the conditions and circumstances that enhanced the effective use of frameworks and standards, including:

- The best-case scenario schools and districts engaged the standards documents from a foundation of previous reform activity.
- Framework use was most effective as part of a whole-school change strategy that promoted a collegial and professional school culture.
- Extensive and intensive professional development opportunities that focused on standards were essential to using frameworks effectively.

In addition to these supportive conditions, the cases revealed that districts and schools adapted the standards and framework documents rather than adopted them. However, in our best-case scenarios, the schools and the teachers had the capacity to add value to the guidance during the adaptation process. These cases suggest that reformers

at the top of the system are always dependent to some degree on reformers at the bottom of the system—suggesting that capacity building is a key to successful implementation.

Even in districts that are using frameworks and standards effectively, some unresolved issues remain, including:

- Local involvement with state frameworks tends to emphasize content over pedagogy. The imbalance between the need for changes in both what is taught and how it is taught stems, in part, from states' reluctance to offer guidance on pedagogical issues.
- In all the districts, teachers were struggling with the sometimes conflicting purposes of assessment: assessment for instruction vs. assessment for accountability.
- The districts were only beginning to explore ways to build professional development into the structure and organization of the school day.

As was evident in the district cases, standards-based reform has captured the attention of many professional educators who are trying to improve mathematics and science education, but another significant challenge remains. Even in the best-case scenario districts, standards-based reform has been primarily a professional, not a public, activity. This lack of public involvement with standards is a problem because, regardless of their effectiveness, reform leaders—from the superintendents to the principals—were vulnerable to shifts in public opinion and the political composition of the local school boards. Without stronger public support, even the most promising reform efforts could be scuttled.

Implications for Federal Efforts to Promote Standards-Based Reform

Frameworks can serve as general policy guidance and can be useful to local districts in their reform efforts. Although federal funds lent support to standards-based reform in the states, each state's political and educational context dictated what role the projects would play in the reform effort. The projects' uneven efforts to develop model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification also suggest a need for future ED grants to be based on a more realistic set of assumptions and a more reasonable scope of work.

Much more work is needed before the curriculum frameworks will be well used in a majority of districts and schools. As our case study districts suggest, capacity building is a key to successful implementation. Districts and individual schools need more time and

resources to translate the state frameworks into local curricular guidance, a process that can make the standards more meaningful. Federal support for local implementation of standards would build on the work of the State Curriculum Frameworks Projects and help expand the number of schools that are using standards to create fundamental changes in the way they work.

I. INTRODUCTION

In 1992, the U.S. Department of Education (ED) awarded 3-year grants to the District of Columbia, Florida, Nebraska, New Jersey, New York, and Rhode Island for the development of curriculum frameworks in mathematics or science for grades K-12, together with new approaches to teacher education, certification, and professional development. These grants averaged about $850,000 and ran through September 30, 1995. In 1993, 10 more awards were made to Alaska, Arizona, Arkansas, Delaware, Louisiana, Maine, Massachusetts, Michigan, Oregon, and Wisconsin. The second cohort of states were to complete their projects by September 30, 1996. This final report presents evaluation findings on the State Curriculum Frameworks (SCF) Projects and applies those findings to issues surrounding the implementation of standards-based reform at the state and district levels.

This evaluation has been carried out as part of a larger study in which we are also examining the Regional Consortia Program, which, like the framework grants, is part of the U.S. Department of Education's Dwight D. Eisenhower National Mathematics and Science Program. In this introductory section, we define the term *curriculum framework* and place the State Curriculum Frameworks Projects in the context of the current federal strategy for improving the nation's schools. Following that discussion, we review the report's purposes and methods of the study. Finally, we outline the remainder of the document.

What Is a Curriculum Framework?

Although there are a variety of definitions of a curriculum framework, there is general agreement that curriculum frameworks are based on standards. Standards establish what students should know and be able to do. In the case of the SCF Projects, standards for student learning were seen as national (although not federal) in character. Thus, the solicitation explicitly required projects to build on the standards developed by the National Council of Teachers of Mathematics (NCTM, 1989) and the emerging standards in science under development at that time by the American Association for the Advancement of Science (AAAS, 1993—*Benchmarks*), the National Science Teachers Association (NSTA, 1992—*Scope, Sequence and Coordination*), and/or the National Research Council (1996—*National Science Education Standards*).

In the original solicitation, curriculum frameworks were defined as "guidelines for the content of the curriculum and for how that content should be organized" and viewed as a bridge between the national standards and the classroom [*Federal Register*, *57*(146), July 29, 1992, p. 33602]. The role of the states then was to communicate and adapt these national standards for their particular student populations. Given state-developed frameworks, local educators were "to implement or adapt them for themselves" [*Federal Register*, *57*(146), July 29, 1992, p. 33602].

Typically, states refined the definition, making it clear that curriculum frameworks did not provide detailed curriculum or mandates for specific programs or methods. Instead, curriculum frameworks were general guides with many purposes, as this example from Massachusetts illustrates:

> Curriculum Frameworks are:
>
> - Guides for developing district-wide programs that demonstrate effective learning and teaching strategies;
> - Guides for creating detailed curriculum;
> - Guides for developing classroom and statewide assessments;
> - Guides for selecting instructional materials;
> - Guides for planning professional development;
> - Guides for restructuring schools to support learning;
> - Presentation of critical issues that underlie learning, teaching, and assessment; and
> - Documents that support teachers as they try innovations and investigations that provide high quality learning experiences for each and every student. (*The Massachusetts Curriculum Frameworks, Charting the Course: The Common Chapters of the Massachusetts Curriculum Frameworks*, 1996, p. 6)

Not all states had as ambitious agendas for their curriculum frameworks, but all states based their frameworks on the national standards and expected their frameworks to help advance standards-based reform.

The State Curriculum Frameworks Projects in the Context of Systemic Standards-Based Reform

The State Curriculum Frameworks Projects are an early example of the federal strategy to promote systemic, standards-based reform throughout the nation. The original solicitation makes this point quite clearly: "The Secretary takes this action to focus

Federal financial assistance on State curriculum frameworks as the starting point for systemic improvement in mathematics and science education" [*Federal Register*, *57*(146), July 29, 1992, p. 33602]. Here, systemic reform refers to a model for improving schools that begins with the establishment of high standards for what all students should know and be able to do, the translation of these standards into concrete guidance for educators, and the alignment of the full range of policies and practices (e.g., assessment, preservice education, professional development) to support all students meeting those standards (Smith & O'Day, 1991).

With the State Curriculum Frameworks Projects, the federal government was not attempting to support states in the full range of activities needed to undergo systemic standards-based reform. In fact, the original grant solicitation made it clear that the reform of certain components of the educational system, such as assessment, was beyond the scope of the SCF projects.[1] Yet, consistent with the model of reform, the projects were asked to do more than just develop framework documents. In particular, the solicitation called on grantees to:

- Develop model guidelines for effective approaches to teacher education and certification based on world-class standards and the state curriculum frameworks tied to those standards.
- Develop criteria for teacher recertification, and design and pilot test a model, cost-effective inservice professional development program for teachers based on world-class standards and the state curriculum frameworks tied to those standards. [*Federal Register*, *57*(146), July 29, 1992, pp. 33603-33604]

In summary, then, the SCF projects should be seen as an explicit federal effort to support systemic standards-based reform in the states. States, in turn, agreed to an ambitious reform agenda: first, developing curriculum frameworks in K-12 mathematics and/or science; second, designing new preservice education and certification model guidelines; third, developing criteria for teacher recertification; and fourth, devising and piloting new approaches to inservice professional development. Further, states took on these challenges in the context of an array of other educational reform efforts already under way, funded with both state and federal dollars.

---

[1] The State Curriculum Frameworks Projects should be viewed within the context of the broader federal strategy. In particular, the subsequently enacted Goals 2000 legislation, the Improving America's Schools Act (IASA), and the National Science Foundation's Statewide Systemic Initiatives (SSI) program demonstrate further, and more comprehensive, federal support for systemic reform.

Evaluation Purposes and Methods

The overall purpose of the evaluation is to assess the degree to which the framework projects have contributed to the improvement of mathematics and science education in their states and to explain their success and limitations. The final report has the additional charge to use findings from the evaluation of the 16 State Curriculum Frameworks Projects to better understand the implementation of standards-based reform at the state and district levels. To accomplish this purpose, the report includes key findings from the First and Second Interim Reports, updates and extends those findings, and presents new findings from the last year of data collection activities.

Data collection activities over the course of the 4-year study (1993-1997) were timed to maximize our understanding of both the development and implementation of the projects' products. During the 2nd, 3rd, and 4th years of the study, data collection activities included:

- Review of State Curriculum Frameworks Projects documents, including original proposals, continuation proposals, draft and completed framework documents, drafts and completed documents from model guidelines for teacher education and certification, criteria for recertification and model professional development, and available evaluation materials.
- Review of state data from a variety of secondary sources (see complete list of sources in Appendix A).
- Telephone interviews with project directors, state officials, SSI directors, Eisenhower state coordinators, and key participants.

During the 2nd and 3rd years of the study, we also worked with a group of outside educational experts to evaluate the quality of the framework documents. In addition, we conducted 2-day site visits to a sample of four states (Florida, Louisiana, Nebraska, and Oregon) during the 3rd year of the study. In the 4th year of the study, we conducted more intensive week-long site visits to 8 of the 16 states. Those site visits included in-depth interviews with state officials as well as teachers and district officials in a sample of two to three districts in each state. A complete description of the evaluation methods is presented in Appendix B.

In addition, the evaluation team was able to leverage data from other related studies conducted by SRI and its partners. We purposefully designed the data collection activities to take advantage of the national evaluation of NSF's Statewide Systemic Initiatives (SSI), the evaluation of the American Association for the Advancement of Science's Project 2061, the evaluation of the Pew Network for Standards-Based Reform,

and the analysis of the quality of curriculum frameworks carried out by the Council of Chief State School Officers. This coordination resulted in benefits and significant additions to the data collected through this contract's funds. First, our coordination efforts allowed us access to internal case study reports on 10 of the State Curriculum Frameworks Projects that were located in states that also had SSIs. These case studies were particularly valuable because all SSI researchers had been trained to include questions about curriculum frameworks in their interviews. The coordination efforts also took advantage of overlapping staffing among the studies, allowing some members of the study team to visit states (via the SSI evaluation) that were not among our eight-state sample, as well as districts (via the Pew evaluation). Our coordination efforts with the CCSSO study allowed for the use of an important analysis of a sample of existing frameworks, as well as baseline data on frameworks in all 50 states and the District of Columbia. Exhibit 1 illustrates the data collection activities conducted in each of the 16 project states.

Exhibit 1

DATA COLLECTION ACTIVITIES

State	1996 Site Visit	1997 Site Visit	Document Review and Telephone Interviews (1995-97)	Expert Review	Site Visits through Other Studies*
Alaska			X	X	
Arizona			X		
Arkansas			X	X	SSI
Delaware		X	X	X	SSI, Pew
District of Columbia			X		
Florida	X	X	X	X	SSI
Louisiana	X	X	X	X	SSI
Maine		X	X	X	SSI
Massachusetts		X	X	X	SSI
Michigan		X	X	X	SSI
Nebraska	X	X	X	X	SSI
New Jersey			X	X	SSI, AAAS
New York			X		SSI, Pew, AAAS
Oregon	X	X	X	X	Pew
Rhode Island			X	X	SSI
Wisconsin			X		

*SSI = Statewide Systemic Initiative (National Science Foundation)
Pew = Pew Network for Standards-Based Reform (Pew Charitable Trusts)
AAAS = American Association for the Advancement of Science's Project 2061

Organization of the Report

Following this introductory chapter, we present chapters on the progress of the projects, the development process of the projects, and the quality of the projects' frameworks. These chapters include findings from the First and Second Interim Reports, but update and extend those findings on the basis of our final year of data collection. Chapter V presents our most recent data regarding the role of the framework projects in state policy-making. Chapter VI examines the projects' implementation strategies designed to improve teacher practice. Chapter VII focuses on the impact of the frameworks at the district and school levels. This chapter features extended case studies of districts and schools that represent a range of experience with the frameworks. Finally, our concluding chapter reviews the key findings and raises remaining issues.

II. PROGRESS OF THE PROJECTS

Nearly all states are engaged in some form of standards-based reform. Forty-eight states have developed or are developing standards documents in core discipline areas. Forty-two states have developed or are developing new assessment systems that reflect the new standards. Nearly every state is revisiting its other education policies in light of the new standards (Gandal, 1996). The 16 states awarded State Curriculum Frameworks Projects are no exception: all but one project completed a curriculum framework. Even the one state that failed to do so—Arizona—has subsequently developed state content standards and is proceeding to develop performance standards.

At the same time, the experience of the 16 State Curriculum Frameworks Projects illustrates that it is difficult to infuse standards systematically into school reform efforts in a short time. The states' experience with the so-called "other products"—model guidelines for teacher education and certification, criteria for teacher recertification, and a model professional development program—underscores that difficulty. Among the 16 project states, no state completed all the other products in a way that met both the letter and the spirit of the grant agreement. Those states that were best able to claim some progress did so as a result of activities already under way in the state, but not as a result of the project alone. In this chapter, we describe the progress of each of the 16 State Curriculum Frameworks Projects.

Progress on Curriculum Frameworks

The State Curriculum Frameworks Projects were designed to encourage states to incorporate new and emerging national standards in mathematics and science into state frameworks. Although there was wide variation in the format and quality of the documents that the project states produced, 15 of the 16 states completed curriculum frameworks.

As indicated in earlier reports, states focused much of their time, energy, and resources on the development of state curriculum frameworks. The projects are officially over in all the states, including the two states, Maine and Massachusetts, that received no-cost extensions through September 1997. (Oregon received a no-cost extension to April 1997.) However, many states continue to review, revise, and disseminate framework documents. Exhibit 2 displays the status of the frameworks as of summer 1997.

Exhibit 2

STATE PROGRESS ON CURRICULUM FRAMEWORKS

State	Status (Summer 1997)	Title
Cohort 1		
District of Columbia	Completed	*Mathematics, Science, and Technology Curriculum Framework*
Florida	Completed	*Science For All Students*
Nebraska	Completed	*Mathematics and Science Frameworks for Nebraska Schools*
New Jersey	Completed	*New Jersey Mathematics Curriculum Framework*
New York	Completed	*Learning Standards for Mathematics, Science, and Technology*
Rhode Island	Completed	*Mathematical Power for All Students: The Rhode Island Mathematics Curriculum Framework; Science Literacy for All Students: The Rhode Island Science Curriculum Framework*
Cohort 2		
Alaska	Completed	*Math/Science Alaska Framework*
Arizona	Not completed	
Arkansas	Completed	*The Arkansas Science Curriculum Framework; The Arkansas Mathematics Curriculum Framework*
Delaware	Completed	*State of Delaware Mathematics Curriculum Framework; State of Delaware Science Curriculum Framework*
Louisiana	Completed	*Louisiana Science Framework; Louisiana Mathematics Framework*
Maine	Completed	*Maine's Curriculum Framework of Mathematics and Science*
Massachusetts	Completed	*The Massachusetts Science and Technology Curriculum Framework: Owning the Questions Through Science and Technology; The Massachusetts Mathematics Curriculum Framework: Achieving Mathematical Power*
Michigan	Completed	*Michigan Curriculum Framework and Science Education Guidebook*
Oregon	CD-ROM with local project descriptions completed and released	*A Framework for Mathematics/Science Improvement: Case Studies from Oregon*
Wisconsin	Completed except for CD-ROM	*Wisconsin Frameworks in Science and Mathematics*

Two of the projects' frameworks from the Cohort 2 states (those funded from 1993 to 1996) were not completed or have not been released. Arizona halted work on its framework as the result of the 1994 election of a new state superintendent and a change in the state's education policy agenda. In Wisconsin, technologically more sophisticated products required more time to develop. In addition, political changes in the state also altered the project's plans. Wisconsin's Frameworks in Science and Mathematics project (FISM) survived the shifting political sands in the state by relocating its work and its project director to the Midwest Mathematics and Science Eisenhower Regional Consortium at North Central Regional Educational Laboratory in Illinois.

Although Oregon's framework product was eventually released, the project became somewhat marginalized within the state department of education because of changes in personnel and priorities. During the spring of 1997, department officials determined that the project's CD-ROM product was consistent with the 1995 revisions to the Oregon Education Act and distributed it to every school in the state. Factors affecting the development and completion of frameworks are discussed in greater detail in the next chapter.

Progress on the Other Products

In all 16 states, the project paid less attention and devoted fewer resources to drafting and implementing model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification. State progress on devising the other products as of summer 1997 is displayed in Exhibit 3. Note that Rhode Island renegotiated the terms of its framework grant with ED fairly early in the project schedule, so that it was required to produce only framework documents in mathematics and science. New Jersey's grant did not require it to develop criteria for teacher certification. We discuss states' progress on each of these products below.

Model Professional Development Programs

The Department of Education called for grantee states to

> . . . design and pilot test a model, cost-effective inservice professional development program for teachers based upon world-class standards and the State curriculum frameworks tied to those standards. Again, the work of designing these programs must involve collaboration among scholars and specialists, school teachers, and school administrators from public or private schools. In addition, these programs must be pilot tested in a variety of schools throughout the State. [*Federal Register*, 57(146), July 29, 1992, p. 33604]

Exhibit 3

STATE PROGRESS ON OTHER PRODUCTS AND ACTIVITIES (SUMMER 1997)

State	Model Professional Development	Model Guidelines for Teacher Education and Certification	Criteria for Teacher Recertification
Cohort 1			
District of Columbia	Held workshops on frameworks	No document	No document
Florida	Held workshops on frameworks	Separate document addresses teacher education	None
Nebraska	Held workshops on frameworks	Separate document completed	None
New Jersey	Held workshops on frameworks	No document; distributed standards to IHEs	Not part of grant requirement (but state is considering proposal)
New York	Piloted model professional development	Separate document not completed	State task force is considering
Rhode Island	Not part of grant requirement (held workshops on frameworks)	Not part of grant requirement	Not part of grant requirement
Cohort 2			
Alaska	Held workshops on frameworks	Separate state document in progress	Separate state document in progress
Arizona	Suspended	Suspended	Suspended
Arkansas	Held workshops on frameworks	In progress: state task force addressing this	Planning
Delaware	Model in place	Separate document completed	In progress
Louisiana	SSI is using frameworks in professional development	No document	No document
Maine	Professional development is addressed in framework; links to SSI professional development	Addressed in framework	Addressed in framework
Massachusetts	SSI is using frameworks to guide its professional development	In progress: working with IHEs and SSI	New state legislation
Michigan	Piloted model professional development, held workshops on frameworks, and addressed in frameworks	Separate state activities for science and math in progress	Separate state activities for science and math in progress
Oregon	Local professional development projects	State commission revised rules	State commission revised rules
Wisconsin	Held workshops on frameworks	Recommendations in progress	Recommendations in progress

Few of the State Curriculum Frameworks Projects—only Delaware, Michigan, New York, and Oregon—formally designed, piloted, and evaluated model professional development programs. New York designed alternative models and then tested them in two sites in the state. The results were mixed: one site abandoned the pilot; another put in 3 years of work with teachers holding emergency certificates. Oregon encouraged 14 local districts to plan and pilot their own professional development projects. Again, the results were mixed, although each of the local projects reported benefits from its participation. (For more detail on these examples, see Chapter VI.)

Other states show interesting variations on the model professional development requirement. Maine established framework pilot sites that included financial support for professional development and consultants. It also conducted 2-day conferences for teachers based on the frameworks (three to four conferences per year for 300 to 400 teachers at each conference). The Maine framework document has a section on professional development standards, and the issue may become more visible as the state begins serious work on revamping teacher preparation and credentialing. Some of Alaska's distance learning professional development modules are close to being models. A pilot was conducted with math and science curriculum revision teams that included twice-weekly audio and video conference links with university faculty members and guest speakers. There is also a self-guided course for teachers and administrators. Participants in either distance learning course are eligible to receive university credit.

Even though most projects did not design and pilot model, cost-effective professional development programs as envisioned (and required) by the Department of Education, most states did conduct framework-based professional development as an implementation strategy. Indeed, it is widely recognized in the project states that frameworks and standards must be linked to meaningful and sustained professional development opportunities. State and local respondents recognized that framework documents will "sit on the shelf" unless they are distributed in connection with training for teachers and other intended audiences. Framework-based professional development is discussed in more detail in Chapter VI.

Model Guidelines for Teacher Education and Certification

Eight of the framework projects claimed progress toward drafting guidelines for teacher education and certification, but only four—Delaware, Florida, Maine, and Nebraska—have actually completed separate documents or addressed teacher education and certification in their frameworks. In these states and others, the development of these

documents is often due to the work of other state reforms. The establishment of new teacher licensure always occurred outside the framework project itself, typically through the state legislature or a commission mandated by the legislature. The model guidelines, where drafted, simply served as recommendations to those in a position to make actual policy changes.

It is reasonable to assume that the frameworks will become a resource for institutions of higher education. At least three states reported instances of their frameworks being used in teacher education programs. Almost all of Nebraska's teacher training institutions are using the framework document as part of their curriculum in math and science education courses. The evidence is less direct in Florida, but there have been numerous requests to the state department of education by college faculty teaching preservice methods courses who want to use the document in their courses. Florida's framework and its teacher preparation document were sent to the deans of all the state's teacher preparation institutions. In New Jersey, all teacher preparation programs in the state received the framework document.

Criteria for Teacher Recertification

Eight states report changes in teacher recertification policies. However, the framework projects played a minor role in the states' changing policy environments. One state, Maine, addressed teacher recertification in the framework, and a separate state task force has begun to examine these recommendations. In Oregon and Massachusetts, state recertification policies have been changed, but not as a result of the framework projects. However, these policy changes represent fundamental shifts in states' requirements for teachers' continued professional growth. New Jersey is in the process of gathering public comment on its plan to link teacher recertification to the state's core curriculum standards. Separate state committees in New York, Arkansas, Alaska, and Delaware are still working on recertification recommendations, with input from past work of their respective state curriculum framework committees.

Did the Federal Funds Matter?

As we noted at the beginning of the chapter, 48 states have developed or are developing standards documents in core discipline areas. Therefore, it seems likely that the 16 states that received Eisenhower State Curriculum Frameworks Project grants would have developed curriculum frameworks or other standards documents without the grants. However, the grants brought resources that enriched the framework development

process. State officials insist that the grants allowed them to produce stronger documents and disseminate them more widely than they could have without the grants. There is no doubt that federal funds allowed project states more resources and therefore more time, professional staffing, and opportunities for professional development than was the case in most non-project states.

Although the expert reviewers did not compare the quality of frameworks from project and non-project states, our analysis of the reviewers' reports on 35 framework documents, 13 of which were from non-project states, suggests that the range of quality among the project states is as great as the range of quality of the non-project states. For example, the reviewers had equally high praise for the draft Massachusetts Curriculum Framework for Mathematics (a project state) and the California Mathematics Framework (a non-project state). Despite similar ranges of quality among project and non-project states, project states, in general, produced more comprehensive documents. Unlike most non-project states, project states tended to produce documents that went beyond simple lists of content standards, and often included illustrative examples. Some project documents also included guidance on pedagogy, equity, assessment, and other components of the education system.

Even though the states' progress on the other products was uneven, a case can be made that federal funds did help those states that tried to develop model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification. However, on the face of it, the value added by this investment seems to be significantly lower than that of investment in the development of frameworks. We will discuss why this was the case in the next chapter.

Although there is no way of knowing what the states might have done had they not received grants, it is reasonable to assume that the grants added value to the states' standards-based reform efforts. The grants did not guarantee a high-quality or even a completed document or product, but every state official involved in the projects can point to a positive contribution of the grant. Just how lasting those contributions will be remains an open question.

Additional policy implications of the framework projects will be discussed in detail in Chapter V. In the next chapter, we examine the projects' development strategies and the issues they encountered.

III. DEVELOPING FRAMEWORKS AND OTHER PRODUCTS: STRATEGIES AND ISSUES

In this chapter, we describe how the states developed the frameworks and other products and what issues arose during the development process. First, the chapter focuses on framework development by delineating the technical and political challenges the projects faced. Next, the chapter discusses the development of the other products and explains why progress was so uneven.

Developing Frameworks

The typical framework project went through a development process with the following characteristics:

- The development process was organized through the state department of education.[2]
- Committees of university scholars, discipline specialists, teachers, administrators, and occasionally business and community representatives were charged with developing the curriculum framework.
- The actual writing of the document was done by a subcommittee, which brought successive drafts to the full committee for review and comment.
- Typically, the development process began by reviewing national standards (NCTM, *Benchmarks*, and the National Science Education Standards), but the committees viewed these documents as sources of ideas and guides, not as something to be strictly followed.

The use of committees and subcommittees seemed to work well, although most states found that the process of curriculum framework development took more time than they had anticipated.

In addition to the use of committees, most states engaged large numbers of educators in writing and reviewing the framework documents. In Michigan, Florida, Nebraska, and other states, writing and reviewing the frameworks turned out to be an extensive professional development exercise. Many local educators were involved with each of these efforts, which helped the frameworks gain acceptance by their peers. For example, the Nebraska project included a 16-member advisory board, an all-teacher 27-member writing team, a 45-member higher education committee, and 273 teacher

[2] The New Jersey project was housed at Rutgers University, but the New Jersey State Department of Education and the State Board of Education had a major influence on the project's product.

reviewers. Florida circulated monthly drafts to an external committee of almost 400 math and science educators and other interested parties.

Delaware also wanted to facilitate an extensive review process. The state printed 15,000 copies of both the mathematics and science framework drafts. With only 7,300 teachers in the state, every teacher had the opportunity to participate in the review. University mathematics and science departments, the business community (including heavy involvement from Du Pont), mathematics and science specialists from other states, and 32 other groups participated in the review.

In all states, participants most directly involved in the writing of the curriculum framework frequently noted that they grew professionally as a result of their involvement. The more time individuals devoted to developing the framework, the more they seemed to benefit. Brief reviews or one-shot workshops rarely resulted in reports of professional growth by participants.

Beyond the impact of the direct involvement of individuals, some states found ways to strengthen the project, help make it central to the reform agenda, and help insulate it from political changes. Framework planners in Maine and Massachusetts intentionally embedded their development processes in other state activities. In both cases, there was a conceptual and organizational overlap between the framework projects, the SSIs [MESA (Maine Mathematics and Science Alliance) in Maine and PALMS (Partnerships Advancing Learning for Mathematics and Science) in Massachusetts], and the development of other state education policies. The involvement of members of the framework development team with major professional development initiatives, curriculum development projects, or new state assessment development helped ensure that the frameworks played a meaningful role in state reform efforts.

Michigan helped strengthen its project's role in the state by deliberately tying the math and science portions of the multidisciplinary Michigan Curriculum Framework (and the state assessment program) to preexisting state documents that specified "Essential Skills" in math, science, and other disciplines. The frameworks' content standards and benchmarks remain influential, even though the state core curriculum mandates were dropped in 1995. By encompassing state standards and updating earlier goals and objectives documents, the Michigan Curriculum Framework has remained durable in the face of political shifts in the state government and on the state board of education. Because the thrust of these efforts was already endorsed by local educators, a conservative state board of education approved the content standards.

The Politics of Developing a Curriculum Framework

All of the framework projects illustrated the importance of attending to the political and educational traditions of states and school districts. Framework development strategies varied among states, but all were affected by the political context, either in initial choices about the projects or by midcourse corrections necessary to develop documents that were relevant to local educators and acceptable to state leaders.

No project turned out to be more vulnerable to political changes than Arizona's. As mentioned earlier, the Arizona project was halted as a result of the election of a new superintendent with a strong mistrust of federally funded projects like the State Curriculum Frameworks Project. Within the first month of the new state superintendent's term, she dismissed the director of the social studies curriculum framework project and returned the grant to ED. Soon after, the project leadership for the mathematics and science framework project was reassigned. Despite the efforts of the new project leadership to extend the project's life until the "politics settled down," it eventually became clear that the project's activities could not continue. Arizona did go on to use state funds to develop new state standards, but without the participation of many of the key mathematics and science educators in the state.

There were other cases where framework projects had difficulty coping with the political shifts. In Washington, DC, the framework project was overshadowed by the organizational and political chaos engulfing the schools. In 1996, the DC Control Board fired the school system's superintendent and stripped its elected school board of its power. In their place, a board of trustees was appointed and a retired Army general hired as superintendent. The new leader moved aggressively on a number of management fronts, but curriculum was a low priority, given the various infrastructure problems.

Avoiding political shifts was beyond the control of the projects. In those states that underwent such change, there was nothing that the project leadership could do other than press ahead, modify the project if necessary, and hope that the transition period passed quickly. Of course, the development story is not over. Some states will soon need to revisit their frameworks—as Florida and Louisiana are already doing. In addition, the districts are likely to experience some of the same political disruptions that the states encountered as they rethink and revise their local curricula.

The politics of framework development also plays out in ways other than changed leadership and changed education policy agendas. As presented in Exhibit 4, the New

Jersey case offers a particularly interesting view of the politics of framework development.

Exhibit 4

THE NEW JERSEY CURRICULUM FRAMEWORK PROJECT

The New Jersey Mathematics Coalition, centered at Rutgers University, was the only private group to receive a State Curriculum Frameworks Project grant. The Coalition focused its efforts on producing standards and then a curriculum framework in mathematics and collaborated with the New Jersey Department of Education throughout the development process. The January 1995 draft of the framework included four sections: The New Jersey Mathematics Standards, Planning for Change, Implementing the Learning Environment Standards, and Implementing the Process and Content Standards. This study's expert reviewers had high praise for the document. They wrote: "The content reflects higher expectations of students than found in most frameworks and standards documents. . . . It is very demanding and powerful as a core curriculum."

As the document was being developed, the governor and the commissioner called for a complete set of state standards to be used to define the state's fiscal responsibility under its constitutional obligation to provide for "a thorough and efficient education." The idea was to use standards to settle the continuing litigation over the school financing system. One result was that the standards (not the framework) needed to be approved by the State Board of Education in a high-stakes atmosphere.

The Board made significant changes to the 1995 draft standards. Each approved standard is stated more briefly than the draft standards. More significantly, most references to the process for achieving the standard have been dropped, as in these examples:

Draft: All students will develop their understanding of numerical operations through experiences which enable them to construct, explain, select, and apply various methods of computation including mental math, estimation, and the use of calculators, with a reduced role for paper-and-pencil techniques.

Approved: All students will understand, select, and apply various methods of performing numerical operations.

Exhibit 4 (Concluded)

Draft: Posing and solving problems will be a major focus of all students' mathematical activity so that through working with interesting, engaging, and intellectually stimulating situations, they come to understand mathematics and use it effectively.

Approved: All students will develop the ability to pose and solve mathematical problems in mathematics, other disciplines, and everyday experiences.

According to New Jersey officials, the State Board required that the standards be measurable. If the standards were to be used to define a "thorough and efficient" education, it is understandable that the Board might not want to commit, for example, to guaranteeing "interesting, engaging, and intellectually stimulating" learning environments. On the other hand, the study's expert reviewers of the adopted standards were sharply critical of these and other changes. As they wrote:

> Overall, the new versions of the standards seem more sparse, utilitarian, and geared for easy assessment. There has been a corresponding loss in the powerful conception of mathematics to be communicated and in the emphasis on developing meaning for children and developing their understanding of mathematics and its power. This goes along with a deliberate avoidance of anything smacking of affective concern on the ground that this might be seen as imposing values on students.

Despite the changes in the standards, the framework still includes the rich vignettes and a powerful conception of mathematics. Overall, leadership of the New Jersey Mathematics Coalition believes that, despite the changes in the standards, the framework project was a success. They noted that they fought hard to preserve much of the language of the original draft, but that the New Jersey Department of Education wanted "terse language that the public can understand." "Things could have been a lot worse."

The New Jersey example highlights two important themes relevant to the politics of curriculum framework development. First, the project states were careful to avoid public controversy, thereby creating a tension between consensus building and reform. Thus, the state departments (and state boards in some states) faced the challenge of promoting change while avoiding discord. This delicate balance required the use of language that the public understood in order to reduce the chances of a negative reaction, but risked getting no reaction, thereby weakening support for reform.

Oregon officials found themselves confronting the tension between consensus building and reform when the state legislature modified the 1992 Oregon Education Act. Suddenly, terms like "portfolio" were dropped from the education department's lexicon. In Nebraska, the state's long tradition of local control of educational decisions meant that centrally developed guidance was not always well accepted in the 687 districts across the state. Recognizing this fact, the Nebraska project team decided early on that the only document that would be influential in local communities was one that was written primarily by teachers and not by state department officials.

A few projects were more proactive and made significant efforts to build public support. The two most ambitious efforts were in New York and Louisiana. In New York, dissemination of frameworks and standards included the development of a video series for broadcast on public television and presentations by state department officials at public forums. Each year the project produced three videos, for a total of nine videos covering topics such as "Why do we need higher standards?", "Whose schools are these anyway?" (parent video), "Assessment: How do we know what kids know?", and "Road to reform: exemplary programs in New York State."

In Louisiana, the project was folded into the state's overall standards-setting effort, and officials tried to build public support for standards. State officials refined and edited existing standards into a newspaper tabloid version that was distributed throughout the state for a comprehensive "public review." The Council for Better Louisiana helped coordinate a public relations campaign to accompany the distribution of these reader-friendly documents, including research on reactions to the standards-setting effort. Department staff traveled across the state, meeting with varied groups and showing a video on "Why Schools Need to Change," which presented a compelling story of the need for school change from a successful business advocate for schools.

However, even where educating the public was part of the project, the state departments avoided violating local-control sensibilities and politically contentious opportunity-to-learn standards, and used familiar and reassuring language. It is too soon to tell whether the states will be as successful in garnering professional and public support for high standards as they were at avoiding controversy.

A second theme in the politics of curriculum framework development follows from the first: One result of avoiding controversy was that standards and framework development became a professional, not a public, activity for a limited number of professionals. Of course, defining what students should know and be able to do, and

communicating the most effective ways for teachers to help students meet those goals, takes professional expertise. But gaining public and widespread professional acceptance requires more than creation of a high-quality curriculum framework. As we reported in the First Interim Report, those who participated in the development of a curriculum framework benefited most from the document because they had the opportunity to study, analyze, and reflect, giving meaning to the standards. As we discuss later, the implementation of standards and frameworks requires equivalent opportunities for teachers, administrators, and the various publics to understand the meaning and implications of the documents. Not everyone could participate in the development process; writing a curriculum framework was necessarily a limited professional activity. But the challenge for states and local districts was to avoid the temptation to seek shortcuts to implementation.

Just as the educators who wrote the frameworks needed the opportunity to better understand standards, all teachers need an equivalent opportunity to make the standards more meaningful. Similarly, obtaining public support for standards is likely to require varied educational opportunities for the many publics to more fully understand standards and their implications.

Developing the Other Products

The curriculum framework states have followed very different development strategies in addressing the requirement that they develop model guidelines for teacher education and certification, criteria for teacher recertification, and model professional development programs. These strategies can be classified as:

- Drafting a document or a framework chapter that discusses or recommends particular courses of action in these areas of policy and practice.
- Implementing a set of activities, usually framework-based workshops.
- Working with or handing off to an existing task force or project the responsibility for addressing one of these issue areas.
- Choosing not to address particularly difficult issues.

Unlike framework development, the states approached the development of these other products unevenly. What staff accepted as models of professional development ranged from a traditional workshop to pilot-tested programs. Certainly, the project staffs had uneven conceptions of their task. Beyond simple lack of understanding, however, there appear to be more fundamental problems. The first of these is simply emphasis and

sequencing. The original solicitation placed more emphasis on the frameworks than on the other products.[3] Moreover, federal and project emphasis on framework development is understandable, given the logic of systemic reform, which argues for policy alignment with the frameworks. According to that view, frameworks are developed first and then other policies are aligned with them.

In addition to the sequencing of activities and the weaker emphasis placed on the other products, project informants repeatedly argued that they needed more time to complete so many tasks. Some projects did find that the process of developing a framework took longer than they expected, leaving little time for the development of the other products. More time might have helped in some states, but it is difficult to demonstrate that it was a factor in all cases.

Clear Guidance and Monitoring

Another partial explanation for the uneven progress on the other products is the lack of clear guidance and consistent monitoring by ED. From the start, ED funded some projects that lacked clearly defined activities and products associated with non-framework components of the grants. Throughout the life of the grants, frequent staff changes at ED and a lack of attention by ED leadership meant that most states had very little contact with ED and little or no guidance. Many states said that they had no idea who their project officer was. At the same time, no state complained about its relationship with ED. In fact, many of the informants had high praise for the supportive and hands-off stance of the Department. The point is that ED could have helped prevent such uneven progress with clearer expectations and guidance from the start, and a higher level of monitoring.

Beyond the need for clearer expectations and guidance, the Arizona project suggests a problem with financial management and monitoring of grants at ED. The Arizona State Curriculum Frameworks Project got off to a slow start because of staff changes and cuts at the state department of education. As we will describe in Chapter V, changes in state leadership effectively halted work on the project.

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[3] Interestingly, in response to the original announcement of the proposal for the State Curriculum Frameworks Projects in the *Federal Register*, one commentor expressed concern that the "efforts to develop new approaches to teacher education and certification should receive emphasis equal to that given to the implementation of the State curriculum frameworks"—in effect saying that the original guidance clearly made the other products less important. Although the Secretary responded that the proposed priority gave "serious and substantive attention" to the other products, the subsequent histories of the projects indicate that the other products did not receive the same level of effort and resources as framework development.

Throughout the fits and starts of the Arizona Curriculum Frameworks Project, Arizona officials requested extensions and promised a renewal of effort in a series of correspondences with ED. But by the late fall of 1995, it became clear that the project would be unable to deliver on its promises. Arizona officials claim that they received no response from ED to their last request to modify the project, and assumed that their proposal was rejected and that the funds would be automatically returned. ED records indicate that Arizona's request was actually approved.

Arizona had originally been awarded a grant in 1993 with funds made available through three different installments over fiscal years 1993, 1994, and 1995. Because Arizona had not accomplished very much by the end of the first year, ED reduced the amount of money that was to be made available to Arizona in the second fiscal year. Going into the third fiscal year, ED again reduced the amount available to Arizona because of the lack of progress. In the end, ED made $775,402 available to Arizona for its work. By the end of the grant, Arizona had not completed any portion of the project and had spent a total of $162,710.

Why did ED continue to make funds available to Arizona even though Arizona had not made much progress? For ED, part of the problem appears to be a poor financial management system. Program officers in ED were expected to make continuation funding decisions at the end of the first and second years of the grant period even though they did not have easy access to the official financial documents that showed exactly how much Arizona had spent throughout the first and second years of the project.

The history of the Arizona project raises questions about ED's monitoring of the technical and financial side of grants. The weakness of the current financial management system may be solved in the near future. As part of the Education's Central Automated Processing System (EDCAPS), the new Grants Administration and Payments System (GAPS) will replace the current tracking system in 1998. According to ED, GAPS will manage all grant activities under a single system approach and will provide improved grant information management, recipient response time, and accuracy of financial management information. Under the current system, payments to states are not reconciled with specific grant programs until the end of each quarter. GAPS will require that states specify which program the funds are for when they make their requests for payments from ED. Regardless of the effectiveness of the new financial management system, ED still faces the challenge of improving its monitoring system. Without

accurate and timely information on the progress of federally sponsored projects, ED staff will be unable to assist a troubled project or halt a failed one.

The Limits of Policy Influence by the Other Products

One final reason that the projects made such uneven progress on the development of the other products has to do with the nature of the products themselves and the location of the projects in the education system. Frameworks can serve as policy guidance, but teacher education, certification, recertification, and (to a lesser extent) professional development are driven by specific policies. Thus, the areas addressed by the other products are policy sensitive and of concern to a set of interested parties (IHEs, teacher unions, etc.). If the projects were to produce guidelines, criteria, and models that had credibility and were likely to influence policies in these areas, they could not simply produce theoretical documents in isolation from the interested parties and the politics associated with each of these potentially controversial policy areas. The projects were faced with a difficult task, compounded by the fact that they generally were removed from or unfamiliar to the institutions and individuals most invested in the particular policy area.

Several examples from the framework states illustrate these themes. Like many other states, Nebraska was not systematically addressing the development of other products. Moreover, to ensure full ownership by K-12 teachers, the project intentionally excluded representatives from higher education until the project was well under way. However, when framework staff learned about a math professor at a small college who was interested in K-12 math education and the preparation of teachers, the project teamed him up with a science educator from the University of Nebraska-Omaha to write the teacher preparation product. The resulting document was the state's *Guidelines for Teacher Preparation: Mathematics and Science*.

In Alaska, the development of state standards for teachers reflects recommendations from the framework project. However, new certification and recertification requirements aligned with state standards for teachers are not complete. Oregon also revamped teacher licensure rules, but the effort was not related to the framework project.

Several states had explicit or implicit rationales for ignoring or minimizing the development of professional development models and guidelines for teacher certification and teacher recertification. Rhode Island formally negotiated itself out of the requirement to develop other products and returned a portion of the state's framework grant. New

Jersey did not include a plan to develop criteria for teacher recertification in its grant, pointing to the state's lack of recertification policies. Finally, the framework committees in Florida originally planned to develop a professional development model, but abandoned the plan after determining that local needs varied too widely to be addressed by a single model. Florida uses a variety of workshop modules to disseminate the framework and its most visible "other product": the Curriculum Planning Tool.

Conclusion

Thus, the development or lack of development of the other products was a disappointing component of most of the projects. Most states focused on framework development, neglected development of the other products, or ceded responsibility for the other products to official task forces or commissions. However, the root cause of the projects' uneven progress on the other products rests with unrealistic assumptions of the original solicitation. Given rather small sums of money (averaging $850,000 per project) and a limited time (3 years), the four-fold agenda was overly ambitious. In the future, ED might consider avoiding such multifaceted and complex awards. Alternatively, if ED targeted specific activities in multiple awards and required that the projects coordinate their efforts, or gave clear direction as to the level of effort expected on each facet of the grant, the states would be better able to complete all components of the project.

In Chapter IV, we examine the quality of the curriculum frameworks that were developed by the projects.

IV. QUALITY: A REVIEW OF MATHEMATICS AND SCIENCE CURRICULUM FRAMEWORKS

The State Curriculum Frameworks Projects have developed a set of curriculum frameworks in mathematics and science. But how good are these documents? And how are these state documents translated at the local level? Decisions about quality are difficult to make, call for specification of criteria, and ultimately rely on expert judgments. Consequently, from the beginning of the evaluation, the study has been working with a group of 18 distinguished mathematics and science educators.[4] This group of reviewers has developed a process for assessing the quality of framework documents and carried out such an assessment on a sample of 12 framework documents (see Appendix B for details on the methodology of the review).[5] Following the experts' analysis, our study collected 10 local curriculum documents from 5 states and examined their alignment with state frameworks. The results of both of these analyses are presented in this chapter of the report.

The reviewers agreed that their analysis of the curriculum frameworks should be useful to the states. As a result, a confidential report on each state's framework was written and forwarded to the respective state. For purposes of this report, the reviewers and the study team agreed that a cross-framework analysis should avoid criticizing individual state efforts, unless doing so was central to the analysis. This decision was made to discourage simplistic ranking of the states' documents.

The expert reviewers used three broad criteria to judge the quality of the frameworks. The first of these was consistency with the national standards: the National Council of Teachers of Mathematics' (NCTM) *Curriculum and Evaluation Standards for School Mathematics*, the *National Science Education Standards* (NSES), and the American Association for the Advancement of Science's (AAAS) *Benchmarks for Science Literacy*. The reviewers did not approach these national standards documents uncritically, but they did consider them useful tools for analyzing a framework's subject content and pedagogy. The reviewers did not suggest that the states should simply copy

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[4] This group of experts also served two related studies, an NSF-funded study of curriculum frameworks conducted by the Council of Chief State School Officers (CCSSO) and a study of selected textbooks for the American Association for the Advancement of Science's Project 2061.

[5] The 12 documents came from 9 of the 16 curriculum framework states (Alaska, Arkansas, Delaware, Louisiana, Maine, Michigan, New Jersey, Oregon, and Rhode Island) and represented roughly equal numbers of mathematics and science frameworks.

the national standards, but they were concerned that key components of the national standards be reflected in the frameworks.

The second criterion was usability. The reviewers examined each framework with an eye toward whether or not the document spoke to its audience in ways that were likely to be effective. The reviewers examined each framework's language and style, its internal coherence, and the clarity of its message.

The third criterion was equity. The reviewers examined the frameworks to see how equity issues were dealt with, assuming that clear and comprehensive guidance on how to facilitate high achievement in mathematics and science by all students was a necessary component of a good framework.

In general, the reviewers found that state frameworks showed marked progress in expanding beyond a basic-skills emphasis to focus more on higher-order skills for all students in mathematics and science. At the same time, the reviewers found that some of the frameworks omitted some of the major categories of the national standards, suffered from a lack of usability, or failed to convey adequately how equity can be achieved. The reviewers' findings are described in more detail below.

Curriculum Frameworks and Fidelity to the National Standards

Frameworks and National Content Standards

All of the 12 frameworks reviewed acknowledged the influence of the national standards. The fact that each of the 12 frameworks had accepted the national standards is an important, if not surprising, finding. These diverse states' embrace of the national standards lends political support to the standards-based reform effort.

The reviewers found that many of the frameworks captured "the spirit and essence of the national standards and the *Benchmarks* remarkably well." Some frameworks were more explicit than others in their efforts to demonstrate alignment with the national standards. For example, one group of reviewers noted that Maine's framework provided a chart that clearly places the document in the context of the national standards documents (see "Connecting *Maine's Curriculum Framework for Mathematics and Science* with *Maine's Common Core of Learning* and National Standards" in Appendix C). Rhode Island was also specific. The *Science Framework for Rhode Island* delineated the principles that it adapted from the NSES and indicated that "the science benchmarks in this document are adopted or adapted from Project 2061." Other states

simply stated that their frameworks reflected national standards. For example, Louisiana stated that "the *Louisiana Mathematics Curriculum Framework* reflects national standards in defining
K-12 curricula" (p. 6).

The reviewers found that exemplary frameworks were those that not only reflected the national standards, but went beyond them. The draft *New Jersey Mathematics Curriculum Framework* is a good example of a document that goes beyond the NCTM standards. The reviewers cited New Jersey standards #1 and #18:

1. All students will be expected to demonstrate high levels of mathematical thought and will have opportunities for further study in mathematics at all grade levels, including courses beyond traditional geometry and algebra in high school, so that they are continuously challenged to maximize their achievement.

18. All students will develop their understanding of the conceptual underpinnings of calculus through experiences which enable them to describe and analyze how various qualities change, to build informal concepts of infinity and limits, and to use these concepts to model, describe, and analyze natural phenomena. (Chapter 1, pp. 16-17)

As the reviewers noted:

> The content reflects higher expectations of students than found in most framework and standards documents, especially in secondary schools. Where NCTM hedges on mathematics for all students 9-12, this framework extends much of the mathematics for only college-bound to all students, especially the conceptual underpinnings for calculus.
> . . . It is very demanding and powerful as a core curriculum.

As we discussed in the preceding chapter, a subsequent review of the New Jersey document after the mathematics standards were revised and approved by the New Jersey Board of Education found that the revised standards lost some of their power to communicate the vision embodied in the earlier draft. Despite the revisions to the standards, the remainder of the framework document preserved the characteristics that the reviewers found valuable. Given the reviewers' concerns, much of the success of the New Jersey mathematics reform effort will depend on teachers' use of the entire framework document, not just the state-approved standards.

The reviewers found that 5 of the 12 frameworks fell somewhat short of the national standards. Three of the six science curriculum frameworks and two of the six mathematics frameworks omitted or collapsed major content categories that appear in the

national standards documents. In science, those omissions typically included science and technology, science in personal and social perspectives, history and nature of science, health, and mathematics. In mathematics, two of the frameworks omitted or collapsed one or more of the following NCTM content standards: number sense, patterns and functions, communication and reasoning, discrete mathematics, and the underpinnings of calculus.

The reviewers also found examples of frameworks that used the major categories of the standards, but the text designed to explain the fundamental concepts and principles that underlie the standard has been rewritten in such general language that much of the meaning is lost. In one instance, the reviewers compared a content standard from the NSES with one from a science framework. From "Guide to the Content Standard" in NSES (p. 127):

Light, Heat, Electricity, and Magnetism

- Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
- Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.
- Electricity in circuits can produce light, heat, sound, and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass.
- Magnets attract and repel each other and certain kinds of other materials.

By contrast, the state science framework stated: "Identifying and describing the differences in the production and properties of light, heat, sound, electricity and magnetism." The reviewers argued that in this example the national standards had become diluted by generalization, and they doubted that "a teacher or other practitioner could make use of them and certainly could not develop assessment tasks to measure the stated standard."

Frameworks and Other National Standards

The reviewers noted that all but one framework went beyond content standards and directly or indirectly addressed other standards, such as those for teacher preparation and professional development, as well as program and system standards. In those cases

where the frameworks were most explicit about the other standards, the reviewers were often laudatory, as in their review of the draft *New Jersey Mathematics Curriculum Framework*:

> . . . the framework provides examples and models for achieving the four learning environment standards of equity, assessment, technology, and student behavior and attitudes. . . . it includes a sophisticated analysis of the requirement for realizing systemic reform. As the document points out, it is not enough to think about professional development; strategies must also address the broad spectrum of policies and issues. While national documents and most other frameworks do not take seriously the school as an organizational unit, this framework does. It also includes a discussion of the costs involved in incorporating technology.

In examining the 12 frameworks as a whole, the reviewers found that the states paid more attention to content standards than to other standards, such as teaching standards. However, the teaching standards were sometimes reflected in the vignettes, as in this example from the *Delaware Mathematics Curriculum Framework* (p. 45):

Exhibit 5: Chickens and Horses

Mary read the following problem to my fourth grade class: ***For a 4-H project, Veronica is raising chickens and horses. She was feeding her animals one day and she thought of a quiz for her teacher. The next day she told her teacher that her animals have a total of 28 legs. Then she asked, "How many chickens and horses do I have?" Her teacher didn't have any trouble answering her quiz. (Although she did get more than one right answer!)***

I asked my class to see if they could find more than one correct solution to Veronica's problem. Find all of the possible combinations of chickens and horses that Veronica could have. Immediately Juan called out, "I know the answer. It is 7 horses and no chickens."
Mary said that Veronica said she was raising chickens and horses so she must have had some of each animal!

"All right," said Juan, "there are 6 horses and 1 chicken." Bob, who has quietly been working with pencil and paper, says "That will not give you 28 legs." I asked him to explain. Bob continued, "Each horse has four legs and each chicken has two legs, so if you take away 1 horse you must add 2 chickens!" "Six horses would have 24 legs and one chicken would have two legs and that only makes 26 legs." Juan replied, "Then I want to add one more chicken so I have two more legs. That's because 26 + 2 would give me 28 legs." Seeing a puzzled look on Susie's face, I checked to see what the problem was. "Well, I got 12 chickens and 1 horse for an answer and that's very different than Juan's answer. But, that's 28 legs, too."

After some great discussion and explanations, most of the class agreed. "Could we design a way to help us keep track of the correct solutions?" Again, the class made suggestions and all were very involved. They decided to make a table of values and the table was written on the board with the answers that had already been found filled in. The class found two more solutions and then Jamal said, "I see a pattern of numbers of horses and numbers of chickens! We missed 4 chickens and 5 horses and 6 chickens and 4 horses."

I asked the class, "Could we have 5 chickens?" Bill stated that 5 times 2 is 10 and 4 does not divide evenly into the 18 legs that are left over. Do we now have all the possible combinations of horses and chickens? The class was satisfied that we do have all of the possible combinations. We then discussed the patterns they saw in the table.

Then Bonnie created a related problem: ***Veronica then said that she has more chickens than horses, but more horses' feet than chicken's feet. Find the number of chickens and horses that Veronica has.*** I asked for suggestions on how to begin this problem and Susie excitedly said, "Write down the number of legs for each animal in another column in the table. Once the number of legs are calculated, maybe we will see a new pattern."

"Let's find where there are more chickens first," Ryn said, "then we can see where there are more horses' feet than chicken's feet." The class had the answer in a few minutes. At this point I asked the students to form groups and work together to find the answer to the following question which contains additional restraints: ***Veronica's class takes a trip to a local farm where there are horses and chickens in the barnyard. Looking at the animals, Chris counts a total of 16 heads and Anna counts 46 legs. How many horses and how many chickens are there in the barnyard?*** Since we had looked at tables before and the students understood the problem, they worked well together making tables and charts to find the solution. [I explored other ideas with the class also. I asked each student to make up their own story problem using creatures of their choice and I asked them to express the information they were given with variable sentences, i.e., 2C+4H = 46, C+H = 16 or with words.]

COPY AVAILABLE

Other frameworks offered a valuable set of curriculum ideas and activities. However, many fell short of offering the kind of rich examples of good pedagogy necessary to concretely communicate the teaching standards found in the NCTM standards or in the NSES. In Exhibit 6, the reader is offered a compelling view of classroom learning, but the teacher is absent from the scene. However appealing this portrait of student learning is, it offers educators few clues as to what the teacher is supposed to do to facilitate such learning.

Exhibit 6

IN THE CLASSROOM

> Fourth-graders are exploring estuarine soils and plants. After a field trip to the estuary to collect soil samples, the students examine the various soils, noting characteristics of each one (texture and amount of organic matter).
>
> The class discusses student observations and matches soil descriptions (peat, mud, or sand) with the soils. To learn which characteristics enable plants to succeed in particular soil types, groups of children check the soils for water percolation rates.
>
> Next, students synthesize what they have learned through investigation, research, and discussion by "designing" a plant that could live in each of the soil types. Finally, the groups present their plant designs to the rest of the class. The plant may be fictitious or real, but students must explain how the plant is able to get the appropriate amounts of nutrients, gases, and moisture from the soil. The group agrees to investigate further by growing some real plants in each of the different soil types.

Frameworks and Assessments

The reviewers found that all the frameworks attempted to address issues associated with assessments in some fashion, usually classroom-level assessments. Typically, the states described the different kinds of assessment, defined the purposes of assessment, and established qualities of a good assessment system. As the *Science Framework for Rhode Island* explained:

> Many different methods of assessment should be used to assure that all students—those with various abilities, backgrounds, and levels of English language proficiency—have ample opportunity to be challenged by assessment. Moreover, assessment should be an integral part of the learning process, not the end result. An assessment program for students should:
>
> - be coherent and comprehensive;

- be equitable and engage all students;
- be integrated with instructional strategies and curriculum materials to promote effective student learning; and
- provide information that will help yield valid inferences about students' learning.

A few states offered concrete examples of performance indicators in their frameworks. For example, under the Spatial Sense and Geometry Standard in Delaware's mathematics framework, the reviewers pointed to the following performance indicators:

> Through the investigation of meaningful problems, individually or in cooperative groups while using appropriate technology, all students in grades 6-8, building upon the K-5 expectations, will be able to:
>
> 8.60 identify, describe, compare and classify two and three dimensional figures;
> 8.61 use a compass and straight edge as tools for basic geometric constructions;
> 8.62 investigate and discover geometric relationships through the use of manipulatives, constructions and computer graphic software;
> 8.63 create models of sets of three dimensional figures such as a cube, rectangular prism, cylinder and square pyramid;
> 8.64 visualize and draw orthographic projections;
> 8.65 discover and apply geometric properties and relationships such as congruence, similarity, parallelism, perpendicularity and symmetry;
> 8.66 apply geometric properties and relationships to make conjectures.

However, the reviewers noted that some of the performance indicators seem "more like behavioral specification of the performance related to general standards and do not have criteria that would help evaluate performance quality." They also noted the introduction of scoring rubrics in the second volume of the framework, suggesting "the kinds of performance benchmarks that Delaware seems to be seeking to establish."

The reviewers agreed that developing good and appropriate performance assessments is a difficult task, one that requires substantial professional development for teachers. At the same time, some reviewers questioned the fundamental wisdom of relying on performance assessment as a prominent, large-scale measurement strategy. On the other hand, the reviewers pointed out, embedding performance items into classroom instruction is a sensible step.

Usability of the Framework

The second criterion the reviewers applied was the usability of the framework. Regardless of how well aligned the document might be with national standards, its impact on policy-makers and practitioners requires that they can read and understand it and use it to alter their practice. The reviewers examined each framework's style and presentation, its internal coherence, and its use of language.

Style and Presentation

Some frameworks were farther along in the production process than others, but the reviewers clearly appreciated those documents that paid attention to style and presentation. After analyzing *Maine's Curriculum Framework for Mathematics and Science*, the reviewers reported:

> The format, coherence, and readability should serve as a model for other states. The message is clear and consistent. This is not intended to be a how-to manual, rather it presents a vision that is comprehensible and coherent—a standard to follow. This framework provides extensive concrete examples, vignettes, and snapshots which develop the vision thoroughly and help people think about how they might apply this vision in a variety of settings.

The reviewers also found that some of the frameworks were of such length and format that they were overwhelming to the reader. Indexes and graphic organizers were often missing from the frameworks. Some frameworks were attempting to use technology to help ease the use of long and complex guidance. Oregon's framework was to be produced on CD-ROM in an attempt to make it a richer "living document." The reviewers saw this approach as innovative and promising, but asked how Oregon would ensure teachers' access to computers to view the framework.

Internal Coherence

Maintaining internal coherence in a document that is often produced by committee is a major challenge facing all framework developers. The strongest frameworks excelled in this area. The reviewers described the draft *New Jersey Mathematics Curriculum Framework* as such:

> The examples in the framework are consistent with the principles. The vignettes in chapter one were crafted to illustrate multiple standards in realistic classroom settings, rather than presenting a single vignette for each point and standard. These vignettes explicitly demonstrate the standards being addressed. The result is some very compelling pictures of what classroom practice and student engagement might look like if the framework were implemented.

A sample vignette from the *New Jersey Mathematics Curriculum Framework* is presented in Appendix C.

The reviewers noted, particularly among the science frameworks, that some states did an exemplary job of reflecting the national standards and illustrating them through local examples. For example, the reviewers found that Delaware's science framework offered extensive recommended activities that involved local conditions and issues. As they reported: "Some of the content topics, for example, polymer chemistry and the Delaware estuary, reflect local industry and environment, and we find that to be very appropriate in the context of a small state."

Some frameworks made significant efforts to point teachers to further assistance. The *Science Framework for Rhode Island* not only included a bibliography at the end of each section, but it also offered a chapter on resources for teachers, including lists of local, regional, and national organizations and selected curriculum projects. In addition, the Rhode Island framework directed teachers to *What's Out There? A Directory of Science and Mathematics Resources for Educators*.

The reviewers also acknowledged just how difficult it is to develop examples and vignettes that effectively communicate the standards. Reviewers had both high praise and suggestions for the examples in Maine's framework. Although they found the "Snapshot" and "Measuring Up" sections that accompanied the main text to be "distinct strengths of the document," they did not always find the examples well aligned with the text. They found the vignettes provided in the "Beliefs about Best Practices" a "style of examples [that] should be emulated by other frameworks," but wondered why more vignettes were not found in the other sections of the document. An example of one of these vignettes is presented in Appendix C.

The reviewers made similar comments concerning the vignettes in the draft *Mathematics/Science Alaska Curriculum Framework*. As they reported: "Within the context of well-done vignettes, we observed that they could have improved if, throughout, the relevant situations used in the vignettes were more clearly annotated as to the specific discipline they are connecting." The reviewers found that the vignette in Exhibit 7 "would benefit from giving the reader better guidance about how to end the directions." In addition, the reviewers asked: ". . . how does the teacher make decisions about questions and guiding instruction? In bold, the annotations should have stated the 'big ideas,' clarifying the specific mathematics the teacher is getting at in the questioning. What was the teacher's thinking? Why did she choose these particular topics?"

Exhibit 7

MATH - INTERMEDIATE LEVEL: DOG MUSHING

Math Standards: Connections; Content

The teacher is using open-ended questioning strategies, making connections to real-life and to local culture, and using a graphic organizer (KWL Chart).

It is 8:00 am. Mrs. Titus greets her students at the door. The students are studying dog mushing. Today they will be discussing how to find out how much it costs to raise a team of dogs.

Mrs. Titus: How many of you have a dog? (Show of hands.) What do you know about how much it costs for your family to keep a dog?

Student: I think we buy 50 lb. of dog food every two weeks.

Mrs. Titus: Are there other costs in caring for a dog?

Student: Every once in a while we have to take the dog to the vet.

Mrs. Titus: Do you know how much it costs to take your dog to the vet?

Student: No.

Mrs. Titus: Would it be possible for you to find out? If you were raising your dog to race in the XYZ dog race, do you think there would be other costs?

Student: I know a musher; I could ask.

The teacher makes a KWL chart during this discussion and fills out the "What We Know" section. She then solicits questions from the students for the "What We Want to Learn" section.

The student invited the musher to come into the classroom to answer questions about raising dogs.

In another example, the reviewers found the sample activities that accompanied each standard in the *Delaware Science Curriculum Framework*:

> . . . to be very process skill oriented and good. They are substantial and specific. For example, on page 29, accompanying substandard 1 on light is a sample activity involving experimenting with different materials to determine how different materials react to light. Another example, on page 70, accompanies a substandard on genetic engineering with an activity involving a classroom debate on bioethical

> issues. It is also good that the document indicates that these are sample activities, so teachers will feel free to modify them.

However, the reviewers also worried that "many of the activities could be interpreted in a cookbook fashion." The reviewers cited the sample activity on page 27 that suggests students "investigate the influence of the sun on temperature. For instance, record and compare air and water temperatures at day and night, temperatures at various times of the day, and temperatures on a cloudy day." The reviewers feared that a teacher might simply give students worksheets and ask them to collect data, arguing that the "framework does not work the example in a constructivist way. For example, suggesting that the teachers encourage students to come up with and test their own hypothesis about how the sun affects temperature."

The reviewers also found that, in terms of both style and content, many of the frameworks suffered from a lack of internal coherence. These problems were usually found in the examples or vignettes. One group of reviewers criticized one framework for its examples:

> The examples lack commentary that could help the reader identify the specific content objectives and specific student or teacher actions to receive special notice. The role of the mathematics content in some examples is not clear. For example, a middle school computation and estimation unit constructing a model city, that requires 5 to 7 weeks, does not specify what computation or estimation objectives are addressed. The teacher is fairly invisible in many examples, so the opportunity to illustrate the vision of good teaching has been lost.

The reviewers also found that the absence of concrete examples may send the wrong message to teachers. In one case, the reviewers found that: "The examples do not consistently illustrate principles of the standards (i.e., reasoning, problem solving, communication), leaving the impression that they are not consistently supported."

The Language of Reform

The reviewers argued that the frameworks, along with much of the current standards-based reform effort, suffered from the use of rhetoric that lacked precision and was susceptible to misinterpretation and sharp criticism. Although educators are often accused of using buzzwords and speaking in vague terms, the reviewers went farther to argue that a number of central terms are confused in the national reform rhetoric in mathematics and science education or are used naively without consistency across frameworks and documents. These terms include *vision, goals, objectives, curriculum standards, content standards,* and *performance standards*. The reviewers argued that

these terms and others are used in an inconsistent, overlapping way both among and within frameworks. They called for clarification and guidance for consistent use of these terms.

Some frameworks received specific criticism regarding the language they used. In one case, the reviewers reported:

> One issue that needs to be resolved is the use of the terms standards, benchmarks, goals, and objectives. The original document set forth a set of goals and objectives, which appear to be the same as the draft standards. The standards appear to be what is traditionally considered as content standards. A key is needed somewhere to help the user to determine how these terms are related to each other. Consistency of language across multiple documents from the same source is important if the message is to be understood.

More generally, the reviewers objected to the misuse and overuse of the term *equity*. The reviewers asserted that *equity* involves a variety of concerns that are often lumped together and used without differentiation. They pointed out that the frameworks and the reform movement in general use the term *equity* carelessly to refer to ethnic minority and underrepresented groups, gender issues, equality of access, equality of outcomes, equality of resources for various subpopulations, the multicultural basis for the development of science and mathematics, and/or attention to groups with different interests and learning styles (including individual learning versus learning in groups, and so forth).

In addition, the reviewers argued that a number of terms from pedagogical concerns, models of learning, and styles of teaching are also used in unclarified forms. For example, such terms as *constructivism*, *conceptual understanding*, *inquiry-based learning*, *activity-based learning*, *relevant*, *applied*, *realistic*, and *real world* have come to cloud rather than clarify what is meant. The reviewers maintained that many of these terms are not bad in and of themselves, but they are often used ambiguously, inconsistently, or without precise meaning and thus detract from discussion rather than furthering it. In particular, *constructivism* is often interpreted to mean that young children construct their own science (or mathematical) knowledge *de novo* and is a misreading, if not a destructive interpretation, of research on the epistemology of science and the construction of canonical knowledge by scientists and mathematicians.

The reviewers went on to argue that careless use of language and the use of clichés often raises concerns, red flags, and sniping from opponents of reform, and even from supporters. Citing the recent attacks on NCTM standards, the reviewers noted that

clichés are often used as shorthands for positions and platforms and are, therefore, easy targets for critics. They pointed out that such clichés may also lead to uninformed support for reform efforts and may be used as a substitute for clear thinking. By using terms currently in vogue, educators may give the impression that an individual document is the product of careful thinking, when in fact the use of clichés becomes a substitute for understanding.

Finally, the reviewers also argued that some reform rhetoric reflects a mechanistic model of designed change and implementation. The language often describes reforms as *coming on-line* or being *rolled out*, *ratcheted up*, or *scaled up*. The current language of reform has an engineering vocabulary, apparently replacing educators' earlier reliance on medical terms like *diagnose* and *remediate*. The reviewers found that the framework writers speak of *leveraging*, *bridging*, *linking*, *forging*, and *operationalizing*. Reformers build frameworks, disseminate them, and implement them. Such language suggests linear systems with causally linked outcomes in the form of improved student performance. The reviewers argued that, in fact, reform is a complex social and political process for which more organic, less mechanistic models and language are appropriate. Reform implies growth and change, and is more like biological change—reflected in diverse ways.

Equity

The third major criterion that the reviewers used in their analysis was that clear and comprehensive guidance on how to facilitate high achievement in mathematics and science by all students was a necessary component of a good framework. The reviewers found that every framework under review made mention of equity issues. However, the reviewers were critical of this component in all the frameworks, including those with the strongest equity components. After analyzing the *New Jersey Mathematics Curriculum Framework*, one group wrote:

> We would like to reinforce the point that the treatment of equity in this framework far exceeds anything we have seen anywhere else. The framework includes a chapter on equity, and makes frequent references to all students and equity issues throughout. . . . However, there is room for improvement. . . . Although the equity chapter is superior to anything else written on equity, to the extent that vignettes carry part of the message, they fail to convey how equity can be achieved.

Other groups of reviewers analyzing other frameworks echoed the finding that the frameworks lack concrete examples and vignettes designed to deal with "the cognitive

implementation of equity-sensitive teaching in the classroom." One group of reviewers found that the draft of the *Alaska Mathematics and Science Curriculum Framework* stood out for the thoroughness and forthrightness with which it addressed the equity issue. They cited the introduction to the equity section of the framework:

> Schools can no longer ignore the interaction of culture and school success. American schools have unjustly favored the students of the dominant culture by ignoring the norms and expectations of other cultures. Culture can be defined as the learning beliefs, understandings, world view, and norms acquired through ethnic, racial, lifestyle, gender, physical disability, or other group identities. Schools must provide equitable opportunities for students of all cultures. . . . Educational equity means more than the provision of equal access to courses, facilities, and programs. It also means designing schools to meet the diverse educational needs of all students through equitable school finance, the school communities, family empowerment, teacher preparation and training, and assessment. (*Alaska Mathematics and Science Curriculum Framework*, Draft, January 1996, pp. 15-16)

Although the reviewers were pleased to see such language, they argued for more. "Combining the sociology of equity issues with more detailed knowledge about children's cognition—going beyond common learning style vernacular—would take an already strong equity statement one important step further."

Although generally critical of the frameworks' treatment of equity issues, the reviewers acknowledged the lack of models of classroom vignettes that give advice and guidance on how to seriously address equity concerns. Referring to one framework, the group reported: "There are only two pages on equity. This is still more than is done in the NCTM standards, but this is no recommendation."

Local Curriculum Documents

The reviewers predicted that local contexts would mediate how the frameworks were actually used, regardless of the quality of the documents. Our subsequent site visits to local districts supported this prediction, as we discuss later, but we also discovered that local translation of state documents varied widely.

In the final year of the evaluation, we gathered 10 local math and science curriculum documents from school districts we visited in 5 project states. In our analysis of these documents, we found great variation in the quality of local documents and in their adherence to the state curriculum frameworks. Some local documents described themselves as curriculum frameworks; others were called curriculum guides. The vast majority acknowledged their state's curriculum frameworks and described their local

document as derived from the state's documents. The primary purpose of the local documents was to present local standards and sample curriculum units. An example of science standards and sample units for the 4th grade is presented in Appendix C.

Local documents varied considerably in their level of detail, especially with regard to sample activities associated with standards or units. Some local curriculum frameworks and guides had no sample activities; others offered extensive sample lessons linked to standards. Similarly, the local documents varied in the amount of guidance they offered in other areas, such as assessment and instructional techniques.

Most local documents we examined contained content standards that corresponded to the content standards in the state framework. Although there was some variation in how the state standards were presented, it was possible to find the state standards reflected in the majority of local documents we examined. But, as was the case with the national standards and the state frameworks, some local documents were more explicitly aligned with the state frameworks than others. In a few cases, the local documents did not seem to reflect the state frameworks at all.

High-quality state curriculum frameworks appear to help districts produce high-quality curriculum frameworks or guides; however, they do not guarantee quality. For example, Massachusetts' highly regarded curriculum frameworks were the basis for the development of two local curriculum documents that we examined. In one case, the local document carefully followed the state's mathematics and science and technology frameworks, and presented detailed lessons that helped illustrate the intention of each of the state frameworks' strands. In the other case, the main strands were presented, but they were followed by extensive lists of objectives that seemed to reflect the district's traditional scope and sequence rather than the state frameworks' emphasis on depth over breadth. In this case, Cohen and Spillane's (1994) prediction that "reformers will do better at addition than subtraction" and that they will be less able to "reduce the clutter of previous programs and policies, or to fundamentally change teaching" appears to have been realized.

Conclusions from the Quality Review

The discussion about the implications of these findings led the reviewers to a broader reexamination of the basic assumptions behind the process of analyzing frameworks and the place of frameworks in the education reform landscape.

First, the reviewers' discussions about cross-framework quality were tempered by the realization that a state's framework may or may not represent great movement on that state's part. Even frameworks that the group believed had many worthwhile features need to be analyzed in terms of their impact. For instance, despite the group's consensus that the *New Jersey Mathematics Curriculum Framework* had many commendable qualities, the framework's quality is irrelevant if it does not become part of the state's reform agenda, is not widely distributed, does not inform and fit closely with other reform activities, and is not accompanied with the supports necessary for it to be useful to its audiences. Moreover, the governor's attempts to use standards to define a "thorough and efficient education" in New Jersey reminded the reviewers that curriculum frameworks exist in a political environment.

The reviewers' findings regarding the quality of the frameworks have some important implications for the implementation of the documents. All the documents reflected the national standards, and as such fulfilled the minimum conditions necessary to bridge those standards to the state and local levels. However, the reviewers found that the documents varied in their usability. If the reviewers are correct about the likely usefulness of the various documents, one would expect to see similar variability in how effectively the documents are able to influence policy and practice. Their concerns about the language of reform suggest that broad agreement about what a framework means may be superficial and may make it more difficult to translate the framework's ideas into good policy and practice.

The challenge in examining the implementation of the frameworks is to understand their fit in the state and local contexts. Regardless of how usable the documents are, state and local contexts will mediate their actual use. Thus, many variables determine the frameworks' influence on the different components of the education system.

Reflections on the Quality Review Process

The extensive state and local efforts to produce curriculum frameworks and other curricular guidance that reflect high standards have resulted in a great deal of interest in assessing the quality of those documents. The American Federation of Teachers' annual reports on state standards and the various reports of the Council of Chief State School Officers are examples of recent attempts to assess quality. As a key component of the evaluation of the State Curriculum Frameworks Projects, our analysis of quality of a sample of framework documents has revealed some important lessons regarding both the process and outcomes of the quality review.

Lessons on the Process

A complete description of the methods used to review curriculum frameworks produced through the projects is presented in Appendix B. Each aspect of those methods turned out to be an important part of the overall success of the review process. However, three features stood out.

First, we purposely selected reviewers who would bring multiple perspectives to the review process. While content specialists were invaluable in helping to determine whether the frameworks reflected the national standards, the mix of state officials, district officials, federal officials, research staff, teachers, and academics enriched the review process. Because of the multiple perspectives, the review process involved an analysis of the frameworks through many lenses, including mathematics and science content, equity, policy, teacher usability, etc.

Second, we devoted extensive time to establishing criteria for judging quality. Those criteria eventually came to reflect the multiple perspectives of the reviewers. More importantly, the criteria were specific enough to provide a common procedural approach to the analysis, but qualitative enough to capture the complexity of the frameworks to be analyzed.

Third, the reviewers' analysis was grounded in background information on each framework's development and the state context that helped shape the document. Research staff provided the reviewers with the background information, and helped underscore the reviewers' original premise that framework documents cannot be analyzed in isolation from their context.

Of course, the review process could be improved. Although the main purpose of the review was to conduct a cross-framework analysis of quality, better interrater reliability on individual documents would have strengthened the process. Small groups of five or six reviewers, selected for their multiple perspectives, analyzed individual documents. Given more time and resources, a quality review by at least two groups of reviewers would have been preferable.

Lessons on the Outcomes

The primary purpose of the review was to assess the overall quality of the curriculum frameworks that resulted from the projects. A secondary purpose was to communicate the findings of individual reviews back to the states. In the end, those purposes were met. However, the quality review also revealed some unexpected outcomes.

Despite the reviewers' desire to assist the individual states in improving their curriculum frameworks, the reviewers' comments were not always welcome in light of state education politics. Particularly when the reviewers were sharply critical of a state's document, those criticisms were not widely distributed by the framework project director. In a few cases, the reviewers' comments did result in further revision of the state frameworks, but the reality of politics could not usually accommodate the reviewers' criticisms. The lesson may be that, unless invited by the states, federally sponsored quality reviews, even by an outside group, are better at assessing the state of the field rather than the state of individual states.

Finally, in meeting the quality review's first purpose, to assess the overall quality of the project's curriculum frameworks, the reviewers argued against mechanistic and linear models of reform. There is a parallel lesson that comes out of the quality review process itself. Rather than produce a systematic and replicable process to assess quality, the review mostly succeeded in sparking the intellectual curiosity of the participants. The time for an investigation into issues of quality and frameworks was right, and the mix of perspectives and personal styles fit together well. The key lesson is that, given time for study and reflection, much can be accomplished and learned, not that a system for determining quality has been established.

V. CURRICULUM FRAMEWORKS AND STATE POLICY

In this chapter, we examine the influence of the frameworks on state policy. As we will illustrate, the State Curriculum Frameworks Projects corresponded with a period of active policy development in the states. Besides developing frameworks or standards documents, the states began developing and piloting new assessment systems, addressing the issue of teacher licensure, and reconsidering a host of other policies. In some cases, these efforts predated the projects.

Did the states respond to the solicitation because they were trying to implement reform or did they try to implement reform because they applied for and received a grant? The evidence suggests that the states that received grants were already trying to implement reform, but that in the vast majority of these states the framework projects were a resource for policy reform. In this chapter, we describe how and where this occurred in the project states, focusing on two key policy areas where the states were especially active: assessment and teacher licensure.

The Influence of the Curriculum Frameworks Projects on Assessment Policy

In the Second Interim Report (Humphrey et al., 1996b), we argued that states were only beginning to come to grips with the operational meaning of aligning education policies with frameworks. By the spring of 1997, policy alignment of the entire education system with high standards in the project states was still a work in progress. In no area of policy-making was this more true than in the reform of state assessment systems.

All but one of the 16 project states were planning, developing, piloting, or implementing new statewide assessment systems. This high level of activity reflected the states' recognition that their current assessment systems did not measure the kinds of student performance expected by emerging national and state standards (Laguarda, Breckenridge, Hightower, & Adelman, 1994). In 10 of the 16 states, the projects' frameworks played a role in the assessment development process (see Exhibit 8).[6] Four

[6] Until recently, Delaware seemed to be well on its way to aligning its educational policies with its Board-approved curriculum frameworks. A new assessment system was under development and a new professional development initiative in place. However, the governor and his new secretary of education recently halted work on the assessment system. Educators' attention has turned to the coming impact of the end of the court-ordered desegregation plan and a statewide choice program. Still, the state's frameworks continue to be used to guide revision of district curriculum. It is too early to tell whether standards-based reform will reemerge at the top of the state's policy agenda.

of the states were not using curriculum frameworks from the projects to develop new assessment systems. In Nebraska, strong local-control traditions have thus far precluded the development of a statewide assessment system. In the District of Columbia, assessment development is on hold for political and financial reasons.

Exhibit 8

THE USE OF FRAMEWORKS IN THE DEVELOPMENT OF STATE ASSESSMENTS

State	Status of New Assessments	Framework Used to Develop?
Alaska	Developing	Yes
Arizona	Developing	No
Arkansas	Piloting	Yes
Delaware	On hold	Yes
District of Columbia	Planning (on hold)	No
Florida	No statewide assessment in science	No
Louisiana	Developing	Yes
Maine	Developing	Yes
Massachusetts	Piloting	Yes
Michigan	Revising	Yes
Nebraska	No statewide assessment	No
New Jersey	Developing	Yes
New York	Developing	Yes
Oregon	Piloting	No
Rhode Island	Mathematics test in place	Yes
Wisconsin	Developing	No

In some states, the frameworks play a particularly important role in the revamping of state assessment systems. In New York, the commissioner has led the state in the direction of high standards by requiring all students to take the challenging Regents Exams. Those tests and the rest of the state assessment system are being revised to reflect the Learning Standards. The mathematics, science, and technology section of the Learning Standards was developed through the project.

The state's curriculum frameworks in Massachusetts are designed to support and guide state policy changes called for in the 1992 Education Reform Act. The math and science frameworks were used as models for the development of frameworks in other disciplines. A new state test (the Massachusetts Comprehensive Assessment System) is being written and will be aligned with the frameworks. Similarly, Alaska has embarked on an effort to align its state policies with standards for all disciplines. The framework grant was received after standards development was under way, and the framework document incorporates the standards. These standards, in turn, are informing the development of a statewide assessment system.

Exhibit 8 also illustrates that in 6 of the 16 states, policy-makers did not use the federally funded frameworks to develop new assessments. However, four of those six states are actively planning or developing new assessment systems. Clearly, having a completed framework project was not a necessary criterion for developing a new state assessment system. Although some states did systematically integrate the project's frameworks into broader state reforms, these four states worked to revise their assessment systems without the use of curriculum framework developed through the projects. The disconnection between the framework projects and assessment development can be traced to the difficulties of developing assessments in local-control states, the development of new frameworks in two states, and political shifts at the state level.

The Limits of Policy Reform in Local-Control States

One state has a strong tradition of local control that has thus far precluded the development of statewide assessments. Although the model of systemic reform makes a virtue out of state policy alignment, not all states have education governance systems that lend themselves to such an approach. In Nebraska, the state plays a modest policy role in education. Most Nebraskans see no virtue in state assessment systems or intrusions from the state capitol in Lincoln. Here the frameworks serve strictly instructional purposes. But even in Nebraska, there is some evidence of use of the framework by local districts and higher education institutions. In the three districts we visited, local curriculum guides were revised to match the state mathematics and science framework. State officials reported that this practice was common across the state. State institutions of higher education are reportedly using the framework document in their teacher education programs. In addition, the University of Nebraska at Lincoln increased the number of mathematics and science courses needed for admission, thereby dramatically changing the course-taking patterns in the state.

Replacing the Projects' Frameworks

Two of the states, Florida and Louisiana, produced framework documents through the federal grants but subsequently decided to replace or revise them. Louisiana responded to criticism of the quality of its draft frameworks in mathematics and science by making significant revisions. The revisions coincided with the election of a new governor with a standards-based reform education agenda and the vigorous support of the business community. As a result, the new draft frameworks enjoyed greater visibility and will guide the writing, pilot testing, and implementation of a new state assessment system.

Similarly, Florida originally developed a framework document in science that was designed to move the field "a little bit." Near the end of the grant period, the commissioner decided to develop a new set of standards and frameworks for all of the disciplines. The project's development process became the model for the development of frameworks in other disciplines, and the head of the framework project was charged with directing the larger framework development process. Again, the new set of standards and frameworks will guide development of a new assessment system, although no science assessment is planned at this time.

Political Changes

The primary explanation for four states' not using the projects' frameworks to revise their assessment systems has to do with political changes that disrupted the projects. In Arizona, Wisconsin, Oregon, and the District of Columbia, changes in political leadership or changes in leadership's educational agenda left the projects' frameworks unwanted, unnecessary, or out of sync.

For example, the political and organizational instability of Washington, DC, and its school system has posed a continuous challenge to the framework project. The DC Control Board stripped the elected school board of its decision-making authority and replaced the superintendent with a retired Army general. The new superintendent has focused on management issues, leaving the project marginalized. As one informant reported: "Morale in the system has been horrible for a long time . . . changes in the leadership [are constant] . . . and reform and changes [in practice] are tough anyway."

Arizona offers an even more compelling story of the influence of political change, as we describe in Exhibit 9.

Exhibit 9

THE ARIZONA CURRICULUM FRAMEWORKS PROJECT

The Arizona State Curriculum Frameworks Project got off to a slow start once its proposal was approved in the fall of 1993. At first, the state department of education experienced staff changes and had a difficult time hiring qualified staff to run the project. By September 1994, the project underwent peer review. The reviewers commended the project's plan, but saw the need for more staff time to be dedicated to the project.

Throughout the fall of 1994, committees of teachers, university faculty, and curriculum specialists were formed and began work on revising the state's Essential Skills to reflect NCTM Standards and the emerging National Science Education Standards. The November 1994 elections resulted in the election of a new state superintendent of schools, who quickly made major changes in the Arizona Department of Education. With the superintendent's help, the state initiated the nation's most ambitious charter school program.

Once in office, the new superintendent ordered a halt to the revision of the Essential Skills and downsized the department. The social studies framework project was halted, and the federal funds supporting that project were returned. Despite these changes, some work on the mathematics and science frameworks project did continue. However, the project leadership changed. Those in the department associated with the project hoped that things would settle down and work could resume. But by the late fall of 1995, it became clear that the project was at an end.

In Wisconsin, the governor's attempt to close the state department of education and the eventual downsizing of the department ultimately resulted in the framework project's moving out of state. With approval from Wisconsin officials, the project is being completed at the offices of the Midwest Regional Consortium. There are modest plans for the dissemination of these products in Wisconsin.

The Oregon case is slightly different. Oregon's framework project's product was recently released, after a review by state officials who were concerned that it did not reflect the 1995 revisions to the 1992 Oregon Education Act. The state is piloting new assessments that students must pass to earn Certificates of Initial and Advanced Mastery, although the project's product has not been used to guide those new assessments. We describe the Oregon case in more detail in Exhibit 10.

Exhibit 10

OREGON'S STRUGGLE FOR STANDARDS

In accordance with the provisions of the Oregon Education Act (OEA), the state department of education created the Common Curriculum Goals (CCG), which the state board adopted in October 1996. The CCG "describe the comprehensive K-12 curriculum required in all districts"; however, separate statements, the Content Standards, describe what the state will assess. Most Content Standards are further specified at grades 3, 5, 8, and 10 by Benchmarks, statements that "establish what students must know and be able to do on state tests and classroom assignments." The Content Standards and the Benchmarks do not cover all that is entailed in the Common Curriculum Goals, calling into question the motivation for teaching beyond what will be examined on the state assessments.

Students demonstrating proficiency in the Content Standards will attain the Certificate of Initial Mastery (CIM), a grade 10-equivalent credential. Students will then work to achieve the grade 12-equivalent credential, the Certificate of Advanced Mastery (CAM). Although the state board adopted the CAM in March 1997, the state department is equivocal about whether students must complete the CAM within an "endorsement area," an area of concentration that supposedly will provide students with some training in and knowledge of an occupational cluster, such as business and management, natural resources systems, industrial and engineering systems, or health services. Skeptics point out that students have little motivation to strive for the CIM and CAM if their high school diplomas are sufficient for college admission.

While the state department has been defining the CIM and CAM requirements, the Oregon State System of Higher Education (OSSHE) has been running on a parallel track in defining admission standards for state colleges. The Proficiency-based Admission Standards System (PASS) Project defines what students entering the higher education system must demonstrate they know and are able to do through a system of multiple-choice assessments, performance-based assessments, and "teacher-verified" work. The PASS standards overlap the CIM in six content areas, in addition to defining another nine process proficiencies, only three of which overlap with the state's career-related learning standards. The PASS assessment system may contain the same components as those of the CAM, but they are not identical.

As our examination of the project states' efforts to develop new assessment systems makes clear, assessment development often proceeded with or without the use of the projects' frameworks. But, regardless of the frameworks' role in the assessment development process, all states faced a series of often confounding issues associated with new statewide assessment systems.

Additional Challenges in the Development and Implementation of New Assessment Systems

Beyond the technical complications of developing reliable and valid assessment systems, states soon discovered that they could not create assessments that would cover all the components of their standards and frameworks. To do so would require far more testing time than is thought reasonable. States have been forced to make compromises, as was the case with Oregon. Faced with this dilemma, Oregon selected some of the strands of the state's Common Curriculum Goals (CCG) and called them Content Standards. The selection process meant that some of the Goals, like science and technology and science in personal and social perspectives, would not be assessed.

In some states, the problem of coverage includes entire disciplines. For example, Florida and Alaska have new assessment systems under development that do not include any testing in science. Some state officials worry that teachers, particularly at the elementary level, will deemphasize science in their classrooms.

The student performance on the new assessments also created challenges for the states. Pilots of new assessment systems in Oregon and Arkansas resulted in failure by large numbers of students to meet proficiency levels, particularly in mathematics. The states' political leadership quickly encountered strong public concerns about the tests, particularly on high-stakes examinations. In Arkansas, there has been some delay in implementing the new assessments, in part because of concerns over large-scale failure. (Only 5 percent of African-American and 20 percent of white students reached proficiency on the pilot of Arkansas' new mathematics assessment.) In Oregon, the assessment schedule has been maintained, but 1995 changes to the 1992 Oregon Education Act allow students to receive a high school diploma even if they do not earn a Certificate of Initial Mastery. In Delaware, the governor and the new state superintendent have halted further implementation of the new assessment system, apparently out of concern over the likelihood that large numbers of students would fail the high-stakes exams.

Public concerns over the disproportionate number of minority students failing to achieve proficiency on pilots of new state assessments have also begun to surface. In Portland, Oregon, a coalition of minority groups threatened a boycott of the schools following the publication of the results of recent test scores. The group demanded that the school district take specific steps to close the achievement gap, including holding school principals accountable for student scores. A temporary compromise has been

reached, but it remains to be seen if Portland teachers are currently equipped with the skills, techniques, and resources to avert disappointing gaps in performance on the new assessments.

Despite these challenges, new assessment systems may prove to be a key lever for reform. Much will depend on the state-specific circumstances, such as the availability of help for teachers, student motivation, political risks, and quality of the assessment system. Most states are still developing these new assessment systems, so it is too early to tell how the story will turn out. But judging by the level of anxiety and skepticism expressed by many teachers we have interviewed over the past 3 years and the complexity of the challenges we have identified, the implementation of the new assessments will not be easy.

Aligning Teacher Licensure Policies with the Frameworks

Teacher licensure is another key policy area in which the project states have been very active. Eight of the 16 project states are developing new certification requirements, have them under consideration by the appropriate policy-making body, or have them in place (Exhibit 11). In addition, half of the project states have new recertification requirements in development, under consideration, or in place. Six states used their curriculum frameworks to guide new teacher licensure policies.

As Exhibit 11 illustrates, nine states have been actively developing and implementing new teacher licensure policies that reflect the vision embodied in standards-based reform. In the New Jersey case, the reform effort represents a significant shift in the state's traditional approach. When New Jersey's project began and during most of the grant period, there was no consideration of recertification policies. New Jersey's framework project proposal purposely excluded development of guidelines for recertification, given the state's long tradition of having no policies in this area. But recently, New Jersey's commissioner developed a proposal for recertification rules as part of the state's push for standards-based reform. The recertification proposal is tied to the new state standards and frameworks, and creates a comprehensive statewide professional development plan. The recertification proposal would have outside groups conduct professional development for the state's teachers.

Exhibit 11

NEW TEACHER LICENSURE POLICIES

State	Certification	Recertification	Used Frameworks in Development?
Alaska	Considering	Considering	Yes/Yes
Arizona	None	None	-
Arkansas	Considering	Considering	Yes/Yes
Delaware	Developing	Developing	Yes/Yes
District of Columbia	None	None	-
Florida	None	None	-
Louisiana	None	None	-
Maine	Developing	Developing	Yes/Yes
Massachusetts	None	In place	No
Michigan	None	None	-
Nebraska	Guidelines completed	None	No
New Jersey	Developing	Developing	Yes/Yes
New York	In place	Considering	No/Yes
Oregon	In place	In place	No/No
Rhode Island	None	None	-
Wisconsin	None	None	-

In New York, recertification was considered by the Advisory Council for Certification of School Professionals. When the Council recommended that no new recertification requirements be instituted, the commissioner rejected the recommendation and turned to his Task Force on Teaching to make a different recommendation. The commissioner insists that the state's new Learning Standards require a system of ongoing professional development. Some state officials speculate that the state will require recertification but leave the details to the districts.

In Maine, the legislatively established committee to reform teacher preparation, certification, and continuing professional development policies took a long time getting organized. Between 1996 and 1997, the committee did hold a few meetings, but it was only recently that leadership from Maine's Statewide Systemic Initiative and State Curriculum Framework Project were invited to join the committee. The addition of the

SSI and SCF Project leadership to the committee helps ensure that the framework will help guide the changes in teacher licensure. The committee was beginning to look at an outcomes-based teacher certification process that relied on more than automatic certification by virtue of completing an approved teacher education program.

Arkansas' legislatively mandated Task Force on Teacher Licensure was charged with making recommendations for changes in the way teachers and administrators are prepared in the state. The Task Force was established by Act 236 and is charged with reshaping the whole system of licensure and recertification. Although still under consideration, the Task Force's work was expected to establish middle school certification, a more integrated science credential, and ongoing professional development requirements.

As was the case with state efforts to develop new assessments, some states developed new teacher licensure policies without using the projects' frameworks. Oregon stands out as a state that continues to actively revise its state policies without the project's assistance. The new rules established authorizations at the early childhood, elementary, middle, and high school levels. Teachers earn an "Initial Teaching License" by completing an approved course of study and demonstrating their competency in five areas:

- Plan developmentally appropriate instruction
- Establish a classroom climate conducive to learning
- Engage students
- Evaluate, report, and use information on student progress
- Exhibit professional behaviors.

First-year teachers are assigned to a mentor. After 3 years and the acquisition of a master's degree and an approved professional development program, teachers are eligible for a "Continuing Teaching License." Thereafter, teachers are required to update a professional development plan annually. The lack of resources for professional development, however, could seriously weaken the state's new recertification rules. Successive tax-limitation initiatives have left both the state and the districts without many resources to devote to professional development. In addition, there are questions about the state department of education's capacity to guarantee that the professional development offerings will reflect the state standards and the goals of the state reform effort.

All states face similar challenges regarding adequate resources for professional development. And, like Oregon, all the states face questions about capacity. Massachusetts serves as a case in point. Massachusetts' widely heralded recertification requirements, which were part of the 1992 reform act, proved to have less-than-hoped-for results. Although teachers are now required to acquire continuing professional development points, the state department lacks the capacity to carefully monitor what counts as professional development. In addition, the requirements for completion of 120 professional development points every 5 years resulted in an initial flurry of professional development activity, a drop-off of activity after the first few years, and a lack of quality control. State Board of Education Chair John Silber charged that teachers could get points by going on a cruise. In addition, there is a misalignment with the state's science framework, which pushes for an integration of the disciplines, and recertification, which requires teachers to be certified in one discipline. The state department understands these problems and may have an opportunity to strengthen the program in the near future.

Conclusion

As this chapter demonstrates, the framework project states—like nearly all states—have been extremely active in revamping their policy systems. In particular, there is now unanimous attention to standards for student learning. Exactly how far states have progressed, the specific policies they have paid attention to, and the degree to which the federally funded framework projects have been used in policy development varied widely and depended on a set of state contextual factors.

In 10 of the 16 project states, the Eisenhower State Curriculum Frameworks Projects have played a useful role in helping policy-makers to shape new assessment systems. Half of the project states used the frameworks in the development of new teacher licensure policies. In addition, there is evidence that the projects had some influence in other policy areas. For example, Florida's project became the model for the development of a new generation of frameworks, which promise to be tied to the new state assessment system. The Massachusetts project's use of study groups in mathematics and science has been expanded to other disciplines. And, as we discuss at length in the next chapter, Maine has focused all of the state's professional development offerings on the implementation of its standards and frameworks.

As a result of all of these findings, it is safe to say that the glass is more than half full when it comes to the frameworks' influence on state policy. However, in all states, at

least two factors tended to limit that influence. First, as the name implies, the State Curriculum Frameworks Projects were viewed by some state officials as projects, just like hundreds of other projects they oversaw. For many long-time state department officials, district administrators, and overburdened teachers, a project is something that ends, rather than something to serve as an enduring guide for all state policies. Second, even in states where project leadership thought of the project as part of a grand scheme for changing policy, there was no systematic plan for changing policy. The lack of a comprehensive plan for changing policies is explained partially by the fact that project leadership was typically not well positioned in the state education department to influence high-level decisions. In addition, project leadership usually had expertise in professional development rather than policy-making.

Despite the lack of a systematic plan for changing policy, the majority of frameworks developed through the projects were a useful resource in the states' efforts to make education policy align with the goal of high standards for all students. In that sense, the projects demonstrated the influence that federal policy can have at the state level. It is important to note, however, that in each state it was important that the framework development and aligned efforts were seen as state-driven, not as federal imperatives.

Finally, the project states showed that standards can bring about some measure of policy coherence. The overall level of activity under the standards banner is impressive, and curriculum frameworks were an important piece of standards-based reform efforts in the majority of project states. But even the most coherent set of policies can stand in splendid isolation if they are not accompanied by significant and sustained opportunities for teachers and administrators to incorporate the intent of the policies into their practice. In the next chapter, we turn to an examination of the project states' efforts to help educators use frameworks to improve their practice.

VI. IMPLEMENTATION STRATEGIES FOR IMPROVING TEACHER PRACTICE

In the preceding chapter, we argued that the framework projects have been used to varying degrees to guide state policy-making in assessment, teacher licensure, and other areas. The influence of framework projects on state policy has been in evidence in a majority of states, but the frameworks are typically resources for policy-makers rather than drivers of broader changes in state policy. In fact, the projects devoted more time and attention to introducing teachers to the framework documents through professional development activities than to aligning state policy with the frameworks. In this chapter, we shift our focus to the projects' strategies for using the frameworks to improve teacher practice.

Given the often changing political environments in which the projects operated and the myriad influences on teachers' practices—such as prior knowledge, educational background, experience, available resources, and parents' demands (Grant, Peterson, & Shojgreen-Downer, 1996)—the task of introducing curriculum frameworks as a vehicle to change instruction was far from easy. To succeed, projects had to tackle a series of challenges:

- How to create opportunities and incentives for policy-makers, administrators, parents, and teachers to "pop the shrink wrap" and examine the documents.
- How to promote a deep understanding of the framework contents.
- Given limited resources, how to balance the need to reach large numbers of teachers with the need to provide in-depth professional development on how to effectively implement the frameworks.
- Finally, as the grant ended, how to sustain long-term commitment to the use of frameworks as guiding documents.

Throughout this discussion, it is important to keep in mind that, in many ways, this notion of implementation is not as discrete or linear as it may appear to be. For most states, the curriculum frameworks were not developed and then implemented in an orderly sequence of events. Many states would argue that the projects had no clear line between implementation and development. For example, many projects involved a wide range of stakeholders in the development and review of frameworks to promote buy-in and awareness of the ideas and content. This is particularly true of the approaches taken by projects in New York, Florida, Massachusetts, and Nebraska. In addition, the

projects' implementation strategies continued to evolve and were enacted well after the grant period ended.

Implementation Strategies

As discussed in past reports, states took varied approaches to disseminating the frameworks—in some cases sending copies to every teacher in the state (see Humphrey et al., 1996a). In the hope of preventing an unopened box of frameworks from landing in a district warehouse (as it did in one district we visited), projects developed multifaceted strategies to ensure that the frameworks reached the receptive hands of their intended audiences. Exhibit 12 illustrates the range of approaches taken by states to encourage the examination and implementation of framework documents. The subsequent section will explore each strategy in more detail.

Exhibit 12

CURRICULUM FRAMEWORK IMPLEMENTATION STRATEGIES*

	Professional Development and Technical Assistance	Study Groups	Resource Guides	Pilot Sites	Technology
Alaska	✓			✓	✓
Arizona					
Arkansas	✓			✓	✓
Delaware	✓		✓		✓
District of Columbia	✓		✓		
Florida	✓			✓	✓
Louisiana	✓		✓	✓	✓
Maine	✓	✓	✓	✓	✓
Massachusetts	✓	✓			✓
Michigan	✓		✓		✓
Nebraska	✓				✓
New Jersey	✓				✓
New York	✓		✓		✓
Oregon				✓	✓
Rhode Island	✓				✓
Wisconsin					✓

*Our discussion of these strategies is not limited to project-supported activities.

Professional Development and Technical Assistance

The implementation strategy used most frequently in the 16 states was professional development and technical assistance associated with curriculum frameworks. Not all of these professional development opportunities were paid for with project funds, as the states made efforts to leverage resources to support the implementation process. The type of opportunities that states offered varied across and within states on a number of dimensions, including content, intensity, and duration.

The majority of states employed several different types of professional development and technical assistance activities at the same time. For example, Alaska's project developed a two-pronged approach to professional development. First, the project tapped into existing professional development efforts of the state's Math and Science Consortia, which covered approximately half of all districts. Project staff worked to infuse framework-related content into the Consortia's 3-week summer institutes and 2-day advanced institutes. To reach the non-Consortia-affiliated districts, the project developed two distance learning courses, one targeted at curriculum committees and the other at teachers and administrators. These courses were an orientation to the frameworks and an introduction to the content, instruction, and assessment methods recommended by the frameworks.

Nebraska employed at least three concurrent efforts. Mindful of the local-control tradition in the state, teachers were used as the trainers and presenters of frameworks across the state. Teachers attending the framework workshops received copies of the framework at the workshops, followed by 2 to 7 hours of training. At the same time, the state math and science coordinators were available to provide inservice professional development on the frameworks to districts. In addition, the frameworks were used in teacher preparation programs at the state universities and colleges.

In Florida, the framework project funded six trainers (1/3 time each) to conduct staff development around the state. On one end of the scale, trainers conducted "awareness" sessions at teacher and district conferences and institutes. On the more intensive end, trainers customized workshops for curriculum developers and teachers to meet the demands of regions. For example, in the faster-paced southern part of the state, with many educators to reach, trainers offered 1- to 2-day workshops—allowing them to reach more than 700 people in a 7-week period. In the less densely populated northeastern part of the state, trainers conducted 4-day workshops. All workshops included hands-on activities that introduced and helped educators learn to use the science

framework and the Curriculum Planning Tool. In addition, the state department of education established Area Centers for Educational Enhancement to provide districts with staff development and assistance related to frameworks in all disciplines. Because the state is developing assessments in mathematics and reading but not science, recent activity in the Area Centers has not focused on science (the content area funded by the Eisenhower SCF grant).

Delaware's Elementary Science Project involved 63 elementary schools in nine school districts. Leaders at each school received 30 hours of training per year, as well as 5 additional days of training. Training was linked to existing curriculum units in kits from the Smithsonian's National Science Resource Center. Sessions focused on science content, teaching strategies, assessment, and classroom management, as well as the curriculum materials in the kits and standards. The lead teachers were expected to follow up and assist teachers in their schools with similar curriculum activities. In 1995-96, approximately 350 teachers participated, and in the 1996-97 school year, another 900 were involved. Delaware also delivered professional development to high school teachers in its schools via the Science Van Project. In 1996-97, 32 teachers of biology and chemistry in 17 high schools participated. Paid for by private-sector funds, the van brought equipment, materials, and science teacher leaders to the schools to demonstrate a lesson and work with each teacher for 2 to 3 days.

Similar descriptions could be made of most of the other projects, but a few states had particularly ambitious and exemplary professional strategies. Maine's professional development strategy worked well because it linked to other reform efforts and resources in the state. As a small state, Maine had significant advantages over large states like New York. However, its approach warrants the more detailed description we present in Exhibit 13.

Exhibit 13

PROFESSIONAL DEVELOPMENT IN SUPPORT OF STANDARDS-BASED REFORM IN MAINE

Maine has dedicated much of the state's professional development resources to helping teachers understand and use the mathematics and science curriculum framework. The state's multifaceted plan represented a coordinated effort, garnering funds from a variety of federal, state, and regional sources.

A key roll-out vehicle for Maine included 2-day Problem Solving in Science and Math (PRISM) conferences. Co-sponsored by the state department of education, the Eisenhower state program, the state math and science teachers' associations, and the state SSI, these conferences are held three or four times per year and enroll approximately 300 to 400 teachers each. Organized for grade-level clusters, the conferences contained interactive introductory workshops on the framework, as well as more advanced sessions for the 1/2 to 1/3 of teachers who had previous exposure to the framework.

During one PRISM workshop that we attended, on using frameworks to guide assessment and instruction, workshop leaders spent time on very precise analysis of classroom assessment approaches, making explicit links to specific performance indicators from the framework. Workshop leaders also offered an introduction to the development of rubrics for classroom use. In another session, teachers were introduced to the frameworks, participated in a series of hands-on activities related to specific content standards, and broke into groups to discuss key questions, including the relevance of standards, how the critical-skills model supports the use of standards, and questions related to classroom implementation. Teachers we spoke to after the session seemed enthusiastic, although concerned about the amount of time they will need to incorporate these new practices into their teaching.

In addition to the PRISM conferences, two sources provided districts with technical assistance related to the frameworks: (1) fourteen SSI specialists provided a range of assistance, from introduction to the frameworks, to mapping local curriculum and textbooks into the frameworks, to linking the frameworks with student assessment; and (2) the state department of education's Regional Education Support Teams (RESTs) devoted 50 days to math and science annually and helped local educators learn to use the frameworks. Both groups held a joint training in the summer of 1996 to ensure that they infused similar content and approaches into their technical assistance efforts.

Exhibit 13 (Concluded)

The framework project also tapped into existing regional networks of educational leaders to provide facilitated "courses" on the frameworks. Educators in these courses were later expected to participate in leadership networks within districts. Lasting either 2 full days with two after-school follow-up sessions or six after-school sessions, each course involved a team of 12 to 40 district teachers. Nearly every district in the southern region of the state took advantage of this opportunity. With assistance from SSI Beacon facilitators, teams were expected to (1) know the content of the framework and how it could influence curriculum, instruction, and assessment; (2) become part of a district-level leadership network that planned and shared strategies for using the framework; and (3) put together a portfolio describing school and/or district projects.

At the beginning of its framework project, Maine selected six schools to serve as pilot sites (five were funded by the Eisenhower grant and one by the Regional Consortium). The schools represented a range of stages in the mathematics and science reform process, and each received a 1-year grant of $10,000 to cover costs of release time, professional development materials and consultants, and/or travel to workshops and meetings. Although some made more progress than others, and many experienced difficulties, the endeavor was considered fairly successful, yielding instructive lessons for others.

The state prepared a case study of each site that will be included in an Instructional Resource Manual. It is hoped that the case studies will serve as a "how to" guide for other schools trying to implement the framework. Besides the case studies of the pilot schools, the manual will include curriculum units developed by K-12 math and science teachers that list outcomes, instructional strategies, and sample assessments. Maine also used SSI-funded Beacon Centers in the roll-out of the framework. Like the pilot sites, Beacon schools experimented with and chronicled their experiences with framework- and standards-based reform.

Much of the professional development activity in support of the frameworks in Maine was a direct result of the close links that the project established with other reform initiatives. Notably, Maine established an advisory board that served both the framework project and the state's SSI. In addition to close ties to the SSI, Maine used local Goals 2000 grants to support technical assistance on use of the framework. Goals 2000 funds also allowed districts to continue work started with frameworks project funds. For example, one project-sponsored pilot site received a $25,000 Goals 2000 grant that allowed it to build on its previous year's efforts to implement districtwide change based on frameworks and standards. We also found examples of professional development opportunities in support of the frameworks that were partly funded by Title I, state Eisenhower Professional Development funds, NYNEX, and the Regional Alliance.

The Maine example suggests two components of an effective implementation strategy that were in evidence in some of the other states. Project leaders recognized the need for additional support materials, realizing that the curriculum framework lacked enough direction or examples for teachers. In addition, project leaders were particularly successful in using other professional development resources to help introduce the framework to teachers. We turn to examples of these two strategies in other states in the next two sections.

Resource Guides

As was the case in Maine, other states developed or are developing documents designed to accompany curriculum frameworks and state standards. In Michigan, a Science Education Guidebook was developed with project funds to translate the well-established state science curriculum framework into classroom practice.[7] Developers hoped that this guidebook would serve as a resource to teachers unable to attend training opportunities. The document covers a wide array of topics: highlights of links between the guidebook and the framework; practical suggestions for planning science programs, including sample plans, scope and sequence charts, and additional resources; information on teaching strategies from *Science for All Americans*; highlights of the state assessment program; and synopses of instructional modules from state and national sources. Michigan project staff also developed the "Connecting with the Learner" toolkit, which was released in 1997. The toolkit was designed to help curriculum developers and workshop facilitators integrate equity issues into the curriculum. This resource consists of 50 activities divided into 6 categories: curriculum, instructional strategies, partnering with parents, learning styles, model programs, and examining beliefs.

Similarly, Florida produced a Curriculum Planning Tool (CPT) that includes ideas for developing curriculum linked to the science framework (in the last year, it was expanded to include all seven subjects covered by new state standards). The document includes example activities from districts around the state and approximately one lesson plan for each benchmark outlined in the state standards. Because of several obstacles, however, the quality of the final product was lower than had been expected. The CPT was originally produced on diskette and placed on the Internet, which for many educators was not easily accessible. Although it recently produced a limited version on CD-ROM, the state is still working to upgrade the version and increase production. In addition, the

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[7] Given that the state had already produced a high-quality and well-respected science curriculum framework, the Eisenhower framework funds for science were deployed to underwrite the guidebook.

amount of research necessary to investigate possible copyright problems reduced the number of activities that were ultimately included in the document. Finally, there seems to be confusion over the purpose of the CPT. Whereas some saw it as a compendium of choices with multiple lessons per benchmark, project staff argue that its purpose was to stimulate teachers' development of their own lesson plans aligned with state standards. Nevertheless, the tool has been used widely and, apparently, teachers find it to be useful.

New York also produced resource guides for its curriculum framework and standards documents. Although produced with non-Eisenhower funds, the guides explicitly refer to the framework and offer examples of resource and research material that can serve to inform local curriculum development. Available on the state department of education's Web site, the *Mathematics, Science, and Technology Resource Guide* is divided into three parts. The first section contains elements considered essential in planning standards-based math, science, and technology curriculum. This includes strategies for integration and creating equitable learning environments, best practices, and samples of curriculum, scope and sequence materials, and assessments. The second section details experiences of classroom teachers, including example activities used to "bring the learning standards to life in the classroom." The titles of some of these learning experiences include: "Math, Monarchs, and Metamorphosis; and Exploring Transformations," "Inverse (Indirect) Machines; and Statistics of the M&M Candy," and "Bill and Ted's Eggsellent Adventure." The final part examines assessment models, including examples of integrated math, science, and technology tasks and materials developed across the state.

Developing and disseminating state guidance on curriculum and pedagogy remains a delicate balancing act in some states. In Massachusetts, concerns over offending local-control sentiments with a state-sponsored, seemingly prescriptive document have delayed the development and release of a framework implementation guide. However, Massachusetts has been very active in offering professional development opportunities to help teachers identify curriculum materials that are aligned with the frameworks.

Technology

Most states used technology—albeit in a limited capacity in most cases—to increase awareness of and access to the curriculum frameworks. Many states have placed the curriculum frameworks and/or other products on the Internet, including Alaska (reference kit), Arkansas (frameworks), Florida (Curriculum Planning Tool), Massachusetts (frameworks), New Jersey (frameworks), New York (frameworks), and

Rhode Island (frameworks). Although making the documents available is the first step, the more critical issue is ensuring use of these resources. Unfortunately, few states have data indicating the number of educators who have logged onto the Internet to view these documents. Given the uneven technological capacity of schools across the country, it is fair to estimate that many teachers have not taken advantage of the electronic information.

A few states have used technology to influence educators directly. Maine's interactive television system was used for awareness and feedback sessions that were conducted live and also made available free on videotape. Two of the three major professional development efforts in Alaska used distance learning and/or videotapes. For example, a teacher and administrator professional development course occurred via one-way video and two-way sound. Organizers planned to deliver this course on video by mail and some type of electronic or audio correspondence with instructors at the University of Alaska Southeast.

Several states' experiments with technology, although partly successful, uncovered the limits of this medium. For example, Florida struggled to produce its resource tool on CD-ROM, eventually producing a limited version. Oregon's product, a CD-ROM compilation of 14 district projects, encountered similar limitations. Not anticipating the rapid changes in technology, the project invested in a presentation format that is now out of date. The final product failed to capture the full breadth of the local experience, since the majority of information was presented in text form. Photos were included, but the lack of motion video clearly dated the technology.

Local Sites

Like Maine, a few states chose to pilot frameworks in local sites. This strategy was designed to have pilot sites serve as examples for other sites attempting to translate frameworks into actual curriculum and instruction. This strategy was working well in Maine, but other states that sponsored pilot districts or schools had mixed results.

For example, Florida reportedly piloted the science framework in 35 SSI-funded model schools. The model schools were to provide a place where people could go and see working programs. The strategy established strong ties between the framework project and the SSI, but the Florida SSI was defunded by NSF. New York planned to pilot the new Learning Standards in the 10 SSI Research and Demonstration schools that were the focus of its SSI, but not all the schools paid attention to the Learning Standards.

Arkansas' attempt to use local sites as "beacons" of reform did not go well. The project selected six pilot districts to develop model curriculum guides based on the state framework. Each participating district received $8,000 for release time, substitutes, and stipends for participating teachers. District representatives received some training, but teachers we interviewed complained about the lack of adequate support. In one of the districts, teachers indicated that being put on the committee to develop the curriculum guides was a form of punishment. The pilot districts produced curriculum guides that failed to reflect the vision of state officials. Typically, the guides contained long lists of textbook page numbers that were associated with each strand of the state curriculum framework. Despite the poor quality, the state distributed some of the guides to all the districts in the state with instructions to revise their curriculum guides in line with the framework. State officials estimate that 20 percent of the districts either did nothing or copied the curriculum guide of another district, while 25 percent of the districts took the task seriously.

Oregon's unique framework project was focused on local sites and their efforts to implement standards, rather than on the creation of a framework document. As we discussed earlier, the project's intention was to capture each of the local site initiatives on CD-ROM and distribute it to all the districts in the state. The local initiatives illustrated some of the challenges associated with standards implementation at the local level. Although some local initiatives made significant contributions to the schools and districts, others suffered from personnel changes or a lack of leadership. Nearly all the local initiatives faced the challenge of being another project among dozens of projects.

Study Groups

One strategy that was unique to Massachusetts was the use of study groups. In Massachusetts, the framework project funded district study groups designed to engage teachers and administrators in discussions about how to integrate the state curriculum frameworks into their districts. Winning proposals entitled districts to send a representative to statewide training on group facilitation and receive funding for 1 year to examine the frameworks.

In general, teams of 8 to 10 teachers and administrators served on study groups for each discipline. Going page by page through the documents, the groups discussed the ideas, interpreted them into matching classroom activities, and identified materials available to implement these activities. One Boston study group came up with themes for each grade level that correlated with the frameworks: teachers left the group with a

specific activity or plan that they could share with other teachers at their grade level and implement in their classrooms. Several districts used study groups to develop their own curriculum frameworks and guides, further specifying the broader state-level documents. In year 2 of the grant, there were 366 study groups in math and 357 in science statewide. The state is replicating the study group model in its implementation strategy for the other disciplines' frameworks.

Links to Other Reform Efforts

In all 16 states, the Curriculum Frameworks Project was one of many reform efforts under way. As in the Maine example, states that purposefully designed their projects to link with these other initiatives were best able to help teachers understand and use the frameworks. In states such as Maine, Massachusetts, and Michigan, many federal- and state-sponsored reform initiatives converged—they shared common leadership and jointly sponsored activities, making the pieces indistinguishable from the whole. With these links, projects were also well suited to sustain their efforts once the Eisenhower grants ended. The following section explores the integration of framework projects with other reform initiatives.

Links to NSF's Statewide Systemic Initiatives

Nine of the 16 State Curriculum Frameworks Projects were located in states engaged in Statewide Systemic Initiatives (SSI) funded by the National Science Foundation. Given that the SSIs shared the same general goals of standards-based reform to improve mathematics and science education, most projects forged close links to these initiatives. The considerable resources available to the SSIs ($10 million for 5 years) allowed many of the projects to expand into areas and activities that would not have been feasible with the Eisenhower funds alone.

In several states, the SSI and framework projects were virtually one and the same. Massachusetts's SSI, Partnerships Advancing Learning for Mathematics and Science (PALMS), overlapped with the framework project in terms of goals, activities, and staff. The project director believed that the framework project allowed the state to extend PALMS beyond its pre-K-8 focus to include pre-K-12. The framework project fit perfectly into the PALMS strategic plan, which called for the creation of frameworks, professional development, and other activities to improve the quality of math and science education in the state. In addition, the SSIs continued the work of framework projects once the grants ended.

Although Nebraska's SSI and framework projects were run by different entities, over time the two developed a strong cooperative relationship—co-sponsoring professional development workshops and other activities. Nebraska's SSI was well under way in the state when the framework project began—setting the stage for reforms called for by the Eisenhower project. Working in tandem helped increase the visibility of the state's math and science coordinators and raised awareness of the importance of math and science within K-12 education. Over time, Florida's SSI and framework project also developed a close collaboration that included SSI-sponsored staff development activities focused on the framework and framework piloting in SSI "Discovery Schools."

The other six states that had SSIs and State Curriculum Frameworks Projects followed similar patterns of coordination and cooperation. Those states that housed the SSI and framework projects in separate offices of large state departments, like New York, or in completely different governmental bodies, like Arkansas, faced the biggest coordination challenges. Those states that ran both initiatives out of the same office, like Maine, or institutions, like New Jersey (where both initiatives were housed at Rutgers University), found coordination to be less challenging.

SSI states that did not have State Curriculum Frameworks Projects were often involved in standards and framework development. The lack of a framework grant appears to have limited the resources that those SSI states were able to devote to standards and framework development. However, the success of those development efforts was more closely tied to the overall success of the SSI project and the state context rather than to the presence of a framework grant. For example, Colorado developed influential framework documents with the assistance of the SSI and the leadership of Governor Romer. On the other hand, South Dakota's SSI developed framework documents, but they have yet to become central to state policy-making or teacher practice in the state.

Links to Goals 2000

Although the explicit links between the projects and state Goals 2000 activities are still evolving, we uncovered at least five instances in which the two initiatives worked collaboratively. Several states, such as Massachusetts and New York, placed stipulations on local Goals 2000 grants, insisting that any district receiving funds demonstrate use of state curriculum frameworks and alignment of activities with those frameworks (in Massachusetts, this stipulation applied to study group districts).

Other states, such as Nebraska and Delaware, are using the curriculum frameworks as a springboard for state standards development under Goals 2000. The Nebraska case also illustrates the potentially fragile relationship between the two initiatives. Nebraska framework staff looked on the new standards development efforts with some anxiety, fearing that if the new Goals 2000 standards were declared or perceived to be mandatory, the voluntary flavor and appeal of the antecedent frameworks would be significantly compromised.

In other states, the connection to Goals 2000 seemed to generate momentum for both projects. In Louisiana, Goals 2000-sponsored standards development built on and revised the frameworks developed through the State Curriculum Frameworks Project. At the same time, the linkage to Goals 2000 added visibility and credibility to standards-based reform promoted by the framework project.

Links to Eisenhower State Grant Programs and Regional Consortia

Links between the framework projects and the Eisenhower State Grant Program also evolved over time. Florida state Eisenhower funds provided partial support for curriculum framework committee meetings. In Maine, the state's Eisenhower director was also the SSI's principal investigator, which facilitated collaboration among the various programs. In Massachusetts, districts receiving framework project and Eisenhower funds to conduct study groups needed to demonstrate that they were implementing the curriculum frameworks. Both New York and Nebraska used Eisenhower higher education funds to support workshops on the frameworks and standards. New York also required grant proposals from institutions of higher education to identify which specific standards the proposed project would address.

Some of the Regional Consortia also provided support to the framework projects. In Maine, the Regional Alliance (TERC) provided $10,000 for one of the six pilot sites involved in testing the state framework. In Alaska, a Regional Consortium staff member worked closely with state department staff to provide professional development and technical assistance on the frameworks. In the District of Columbia, the Regional Consortium helped build the capacity of project leadership during the initial years, planning meetings of the advisory board, providing staff development for teachers who were to conduct training, and providing standards materials to schools. Similarly, in Oregon, the Northwest Regional Consortium assisted in the early development of the project. As we reported earlier, the Midwest Consortium for Mathematics and Science Education eventually became the home of the Wisconsin project.

Not all of the Regional Consortia were so directly involved in the projects. However, some Consortia made significant contributions to states that did not have framework grants. For example, the WestEd Regional Consortium played a pivotal role in Utah's development of a science framework.

From Strategies to Impacts

State officials were under no illusions about the challenges of implementing the curriculum frameworks. As the examples of state strategies suggest, 14 of the 16 states employed multiple implementation strategies. The most ambitious strategies maximized teachers' exposure to the documents and provided both the time and resources for teachers to study, reflect, and experiment. These strategies required a coordinated effort—one that garnered the resources of other state, federal, and local reform efforts. It also required that implementation strategies extend beyond the life of the grants.

As we have emphasized earlier, the use of curriculum frameworks by policy-makers and educators continues to evolve. In the 16 project states, most local districts are in the early stages of revising their local curricula and implementing the changes. Having said that, standards-based reform has had some impacts at the district and school levels. In the next chapter, we examine those impacts in a sample of districts as we address the question "What happens to frameworks once they arrive at the district offices?"

VII. IMPACT IN THE DISTRICTS

In the final year of the evaluation, our primary charge was to understand how the frameworks were used once they were distributed. As might be expected, there is great variation across the districts. In some districts, we were hard pressed to find anyone who was familiar with the state's documents. Sometimes, the district had not yet gotten around to dealing with standards, or it was fully engaged in other pressing issues. Recognizing that it was still too early to expect widespread changes in policy and practice, we focused the data collection activities on states and districts where, on the basis of input from state framework personnel, we expected to find districts engaged with the frameworks. Thus, we purposely examined places that would give us insights into how framework documents were being used.

This chapter presents cases of five school districts and three schools that illustrate how the frameworks are used by district officials, principals, and teachers (all district and school names are pseudonyms). These cases portray districts at different stages of reform, each with slightly different experience with state frameworks. They were selected from a sample of 20 districts that we visited in the 8 case study states during the spring of 1997. The cases represent the range of involvement with standards-based reform across the 20 districts. After presenting the cases, we discuss cross-cutting themes. The chapter concludes with a discussion of some of the broader challenges facing teachers as they move ahead with standards-based reform.

Best-Case Scenarios: Use of Frameworks in Districts Well on Their Way to Reform

The first two cases feature districts that appeared to have benefited greatly from the use of their states' frameworks and other standards documents. Our criteria for selecting the best-case scenario cases included:

- Evidence that the district or school was using the framework to guide local curricula and teacher practice.
- Evidence that local curricula and teacher practice reflected the vision described in the state framework.
- Evidence that district policies and school policies supported the implementation of the state framework.

- Evidence that support systems, including professional development opportunities, were available to teachers and administrators in their efforts to implement the state framework.
- Evidence that assessments aligned with the framework were being used to inform teacher practice.

The first case reflects the experience of a district that was far along the path of reform even before it began to use the new state curriculum frameworks. The second case focuses on a successful school that has been actively engaged in reform in a district that has more recently attempted standards-based reform.

Gemtown, Massachusetts: Standards-Based Reform at the District and in Classrooms

Gemtown is a small, middle-class, predominantly white manufacturing city in the southeastern region of Massachusetts. Its school district serves more than 6,000 students in six elementary schools, three middle schools, and one high school.

Guided by a strong-minded superintendent, the Gemtown public schools engaged in education reform efforts before the development of state curriculum frameworks. Early on, the superintendent reassigned teachers and administrators to different schools to shake up the system, required K-8 teachers to teach the same students two years in a row, and established business partnerships for every school. The superintendent also promoted a culture of professionalism within the district. Considered a professional development district for preservice, Gemtown pairs student teachers with panels of master teachers during their preservice and provides them with coaching assistance and opportunities to attend workshops alongside teachers. The district employs a full-time professional development coordinator. In addition, all teachers must take a three-credit course each year to obtain salary increases. Because of its aggressive recruitment efforts, the district has been able to attract teachers from a top university not far from the school.

Before the release of the state frameworks, groups of teachers and administrators developed district Content Standards and Learner Outcomes in each subject area for grades 4, 8, and 12, which reflected the national standards. Gemtown received copies of the frameworks just as it was beginning to implement its own district Content Standards and Learner Outcomes. In 1994-95, the district received support through the State Curriculum Frameworks Project for study groups of volunteer teachers to examine the state documents and compare them with the Gemtown standards. After performing this

comparison, the study groups offered suggestions for revisions to the standards, adding specificity to each grade.

In 1995-96, district study groups developed interim standards for grades 2 through 6. Again, group members drew from state and local standards documents. In the 1996-97 school year, the district used study group funds for articulation. Teachers from different schools and grade levels met to discuss the entire K-12 curriculum and fill in gaps. The science group also developed a scope and sequence for the science curriculum, specifying yearly themes and blocks of study for each K-8 grade.

Given the standards-setting activity that took place before the release of state documents, Gemtown was well situated to move ahead with the actual implementation of standards-based reform. Having chosen science as the lead discipline, the superintendent asked all teachers and administrators to group courses according to science skills, big concepts, and ideas in the frameworks. To support this model, the district devoted two of its three professional development days to the science curriculum framework. In addition, many teachers took advantage of the PALMS (the state's SSI) professional development opportunities.

Thus, although frameworks did not introduce radically new information to the district, they clearly helped to validate the reforms the district had already started to implement. The frameworks also helped to unify teachers and administrators around a common vision, particularly in science education. On the basis of interviews with five teachers and a focus group with six teachers, we had the impression that Gemtown teachers were generally pleased with the direction of the district and the attention being paid to curriculum.

- One teacher said it has pushed him and his colleagues to think about and discuss issues of math and science, that it has raised the importance of examining curriculum and constantly revising it.
- One new teacher, whose training is consistent with the vision advocated in the frameworks, explained that it is a comforting feeling to know that there is unity in the state on what good math and science look like. For her, the frameworks add validity to what she has learned.
- Another teacher said that the frameworks help her plan instruction and help her avoid staying too long on one topic with which she feels comfortable. She also believes the frameworks and district curriculum foster communication among teachers at all schools and help unify the district.
- A high school teacher believes the frameworks help her make modifications in her courses and introduce more skills-based instruction.

Framework use was not restricted to isolated groups of teachers on committees. As the following description suggests, whole-school change was well under way in the district.

Exhibit 14

AN EXEMPLARY GEMTOWN SCHOOL

Bradley Elementary

Throughout the recently renovated building, groups of students worked with peer tutors in wide-open spaces between classrooms. Student projects decorated the hallways and classroom walls.

Last year, teachers were given a release day to examine the curriculum frameworks, and a lot of time was spent after school to discuss them in study groups. This year, the principal asked teachers to take the science curriculum framework and develop a notebook with ideas for instruction and assessment. Using the state curriculum framework and the district curriculum framework guides, teams of teachers created a school curriculum guide with blocks of study for each grade level. For example, in 3rd grade there were blocks covering space, electricity, etc. Second-grade blocks included sound and changes in prehistoric life. The notebook defined what strands need to be taught within each block and included sample assessments with problems that students need to solve and rubrics for scoring. The principal also asked all teachers to keep portfolios to pass on to the students' next teacher.

We were told that teachers start out each day with a problem. Most teachers reserved the afternoon block of 12:45-2:30 for science (rationale: students' enthusiasm for science makes the afternoon hours ideal). Aside from this block, many other daily activities were linked to science. We saw evidence of science themes and integration on the walls of every classroom. In one classroom, stories about dinosaurs hung above collections of rocks, stones, and books about prehistoric life. Another teacher had her class reading a book about Thomas Edison and wove that into lessons on temperature, state geography, and social studies (which states are cold and hot). Another teacher organized an activity around their 101st-day-of-school celebration: each cooperative group was given 101 bones to count out and piece together into a skeleton. This led to lessons on dinosaurs, plant/meat-eaters, and other related topics. The classroom and school hallways were lined with these skeletons. Our brief tour also uncovered a lot of cooperative learning and hands-on activities. Students sat around tables talking about and working together on projects.

Exhibit 14 (Concluded)

Teachers participated in frequent professional development activities and were very enthusiastic. One teacher shared with us her transformative experience with the district's museum sabbatical program. Wanting more content, she signed up and found that it sparked a new interest in science. The program made her feel what it was like to be a learner again, and she has been able to transfer that excitement and learning to her students. The program also provided her with new resources (e.g., kits, guides). She spoke about the power of science to allow students to try new things and help students struggling in other disciplines to gain confidence. All teachers were enthusiastic about the school. Another exuberant teacher bragged about her students' growth and the changes she had undergone in terms of understanding that it was okay to tell students that she did not know all of the answers. Without training in college in math and science, this teacher learned new skills and how not to be afraid of science.

It is worth noting that this was considered to be the "neediest" school in the district, with 40 percent of students receiving free and reduced-price lunch. Bradley was outperforming other schools in the district. The principal boasted of "off the charts" scores on the open-ended portions of the Massachusetts Educational Assessment Program, as well as few discipline problems.

The long-term reform efforts in the district appeared to result in higher student achievement (see Exhibit 15). Results from the 1994 and 1996 Massachusetts Educational Assessment Program (MEAP) showed that Gemtown 4th-graders made 70-point gains in mathematics and 90-point gains in science. Eighth-grade scores jumped 80 points in both mathematics and science, and 10th-grade scores increased 80 points in mathematics and 50 points in science. (According to the state, real educational changes are detected when scaled scores rise or fall at least 50 points.)

Exhibit 15

GEMTOWN AND MASSACHUSETTS MEAP RESULTS
(Scaled Scores)

	Grade 4			Grade 8			Grade 10		
	Gemtown		State Avg.	Gemtown		State Avg.	Gemtown		State Avg.
	1994	1996	1996	1994	1996	1996	1994	1996	1996
Math	1310	1380	1330	1260	1340	1330	1240	1320	1310
Science	1330	1420	1360	1260	1340	1330	1250	1300	1310

Note: Scores provided by the Gemtown Public School System. MEAP scaled scores occur in a range between 1000 and 1600.

Cutler City, New York: Frameworks in the Context of Whole-School Change

The Cutler City public schools enroll about 23,000 students in 27 elementary schools, 4 middle schools, and 4 high schools. The student population is growing rapidly, adding about 1,000 students per year. The district employs about 1,700 teachers.

Through the evaluation of the New York SSI, the Pew Network for Standards-Based Reform, and the Eisenhower State Curriculum Frameworks Project, SRI researchers have closely followed the Cutler City School System since 1993. Cutler City schools became involved in standards-based reform with an early 1990s initiative called Education 2000. Education 2000 resulted in the drafting of a set of general standards and the development of benchmarks for those standards. Most district officials readily admit that the standards were too process oriented and too vague. Since then, the district has begun to focus on the New Standards along with the New York State Learning Standards (the mathematics, science, and technology section developed through the State Curriculum Frameworks Project).

Because of the district's involvement with the New York Statewide Systemic Initiative, district officials and some of the schools were involved in the development of the New York State Learning Standards. Cutler City has also committed to using the New Standards as the core of a professional development initiative sponsored by a large foundation. The district will administer the New Standards Reference Exam to students from those schools that participate in the initiative. District officials are confident that the New Standards are equivalent to the state standards. Some differences are apparent, however. For example, unlike the New Standards, the state emphasizes the integration of mathematics, science, and technology.

Although most schools in the districts are just beginning to use standards documents, several schools have been actively involved with standards-based reform for the past 3 years because of their involvement with the state's SSI. One of those schools has made dramatic improvements in a relatively short time (Exhibit 16).

Exhibit 16

A SCHOOL AHEAD OF ITS DISTRICT

Smithson Elementary School

Smithson Elementary School is a small school (about 600 students) that serves an ethnically diverse student body. The school stands out as having made remarkable progress toward changing the school culture and teacher practice in the vast majority of classrooms.

As an elementary school with a preexisting disposition for reform and a focus on science, it began its participation in the standards-based reform with several advantages not found in most of the other schools in the district. One of the leaders of the reform effort was the union representative, a key ingredient for change with a strongly unionized teaching staff. Much of the reform effort was devoted to allotting time for teachers to read and reflect on research and new curriculum. Study groups became a regular feature of life in the school. Teachers were given opportunities to learn and discuss together in a supportive and safe environment. Key decisions concerning professional development, curriculum, and new initiatives were increasingly made by a steering committee of teachers. Recently, teachers have also instituted a Wednesday morning breakfast club where research and curriculum are discussed. In preparation for the New Standards Reference Exam and in anticipation of the new state assessments, Smithson Elementary School teachers have begun developing sample performance tasks for use in their classrooms.

On the basis of countless interviews and observations over the past 4 years, it was clear that teachers became more confident about their practice, more protective of the school community, and, at the same time, better able to identify what they did not know. Leadership from the principal was important, but the school handled a recent change in principals with ease. The school has built a community of learners, fully aware of how much work they have ahead of them.

Student achievement data seem to support the qualitative evidence of this school's accomplishments. In the spring of 1994, only 75 percent of 3rd-grade students at the school scored above the SRP (State Reference Point) on the state mathematics test. By the spring of 1996, the figure was 93 percent. Similarly, 6th-grade students improved from 82 percent scoring above the SRP on the state mathematics test to 92 percent reaching that level. In science, 4th-grade students correctly answered, on average, 34 out of 40 questions on the manipulative section of the state test, 3 more than other schools with similar demographics.

Using Frameworks: Three Districts Working on Reform

In the next set of three cases, we examine some districts that were actively using the frameworks but were not as far along in the reform process as our best-case scenarios. Here we applied the same criteria as in the best-case scenario cases and placed these districts in the "working on reform" category if they failed to meet one or more of the criteria.

Parkside School District, Maine: Standards-Focused Professional Development

The state framework is having a significant impact on science education in Parkside district, located in a small town in Maine. The 1,700-student district includes one high school, four K-8 schools, and three one- or two-room schools located on islands just off the coast. The district employs about 150 teachers.

When the state framework was published, Parkside was using its own locally developed science framework. After comparing the two documents, Parkside educators decided to build a new local framework using the state framework as a starting point. The local framework development and related curriculum activities have been facilitated by opportunities for substantial, ongoing professional development. The local curriculum work is also a professional growth experience, apart from the formal training that has accompanied it.

For the past year, Parkside teachers have been comparing what is being taught at each grade level with the state's standards in all content areas. Every teacher in Parkside is required to serve on one of the content-area subcommittees. The science subcommittee consists of 28 members and includes teachers from all district schools. Supported by LEA and SSI funds (the Parkside district is one of seven SSI sites in the state), grade-level or grade-level-cluster teams met during the summer of 1996 to work on classroom curricula and assessments. At the K-8 level, this effort included aligning and developing new kit-supported science units.

An example of this process comes from the work of three kindergarten teachers. They worked together to analyze the five science kits that had been developed several years before with local grants as part of the SSI inservice program. The teachers chose to work on the "water" and "critters" kits for their 3-day summer meeting (the other kits have been analyzed since then). Activities proceeded as follows:

Day 1: The team matched the kits to the state content standards, noting activities that could work for assessment (performance indicators). They also matched community, equity, and professional development standards to each kit.

Day 2: Teachers decided to add a content standard for the "water" kit—one that was not addressed in the state framework. The team researched the new standard using the national science standards, the California Benchmarks, and at least one other publication. They then developed an observation checklist to support teacher observation of science inquiry by students.

Day 3: Teachers finalized the mapping so that each kit was associated with the state standards and assessments, and wrote some recommendations for use of the kits by other kindergarten teachers.

During this work, the team found that a number of performance indicators, representing eight content standards in the framework, were not met through the kits. The team then wrote a report for the district detailing the situation and recommending that these be addressed through other classroom activities.

The one district high school has also been involved in related curriculum revisions. The high school, which enrolls 540 students, offered applied science courses, college preparatory courses, and honors courses. A new 9th-grade science course, called Foundations of Science, was developed by two local teachers on an "every science, every year" model. The course included topics in biology, chemistry, and physics and was often interdisciplinary. The science department chair reported that science course-taking patterns have changed at the school in recent years. Many more students were taking college preparatory biology rather than general biology, and enrollments in a third and fourth year of science were up to the extent that the school has just added a new laboratory.

At the K-8 level, a study group met monthly on science curriculum articulation across grade levels. The outcome of this process so far was that the science curricula at the elementary and middle school levels were parallel. Ongoing work includes checking for areas of overlap or omission across grade levels.

The curriculum alignment, revision, and articulation activities described above are important opportunities for professional growth. Yet an additional component that accounts for the success of these activities is the formal professional development that most of the participating teachers have received. Indeed, when Parkside teachers began the activity of aligning the curriculum with the framework, no one was experienced in how to perform the task. Teachers' abilities to develop science curricula have been

enhanced by their participation in statewide working conferences and 2- to 3-week Academies sponsored by the SSI (Parkside is one of seven SSI Beacon sites in the state). A 2-day inservice was held in November 1996 for the science subcommittee. Among the goals of the activity were to develop a progress timeline; to report on the previous summer's work of comparing existing units with the framework; to make the connection between performance indicators, assessment, and teaching practice; to better align scope, sequence, and coordination across grades; to link the Foundations of Science syllabus to the framework; and to revise the 5-year plan.

District professional development will continue to focus on developing an articulated science curriculum by helping teachers identify curriculum holes and duplications for their immediate grade clusters. In addition, understanding that the framework has pushed them toward very different kinds of classroom assessment, individual teachers are pursuing professional development in that area. In the spring of 1997, several district teachers were taking an assessment course offered by an SSI facilitator for University of Maine graduate credit.

Most Parkside teachers appeared to be happy with the attention to curriculum and the changes it has brought about. Middle school teachers said that the matching/mapping activity is the first time the curriculum has gotten serious attention in a long time and that Parkside's standards are now stronger than the state's. They also indicated that there is now more teamwork, more planning time, more professional development, and more contact with colleagues at other schools. According to one respondent, interteacher communication is much greater now than 5 years ago. Teachers are less competitive and more collegial. One teacher mentioned proudly that several Parkside teachers had been asked to take leadership roles in statewide conferences, like the intensive, well-established, state Problem Solving in Science and Math (PRISM) conferences. This counts as another professional development opportunity for the teachers involved.

As in the best-case scenarios, Parkside teachers were deeply involved in a variety of professional development activities. The difference between the first two cases and Parkside appeared to be a matter of time. But given adequate time to build capacity, the district seemed poised to make significant improvements.

Farmville Public School District: School-Level Use of Nebraska's Mathematics and Science Framework

Farmville, Nebraska, is a small community of about 1,000 people. The entire K-12 population of about 300 is housed in one building, along with the district offices. About

half of the students receive free or reduced-price lunches. Nearby World War II-era military barracks have recently been converted into low-income housing. Many of the low-income residents are migrant workers who stay in the community for varying lengths of time. This situation has led to greater demands on the K-12 school and greater mobility for the student population. Enrollment per grade level averages between 20 and 25. Typically, a graduating class includes about 5 students who attend a 4-year college and 10 students who attend the nearby community college.

The district received copies of the Nebraska Mathematics and Science Framework about 2 years ago. The state science coordinator provided the district with a workshop on the frameworks. A few teachers from the school were involved with the state's SSI and first used the frameworks during SSI-sponsored workshops. The region's Education Service Unit also provided some teachers with a workshop that focused on the frameworks. More recently, the state science coordinator visited the district at the district's request to help implement the frameworks.

The district's curriculum revision committees, which included teachers, administrators, and members of the community, were the primary users of the frameworks. The math and science framework has been used as a reference tool by the committees that have been revising curriculum in math and science. Teachers cited the two large charts (one each for math and science) that organize "conceptual threads" and "topic strands" by grade-level cluster and the suggested activities as being "very helpful" to them. The principal of grades 4 through 12 has also used the charts and the frameworks to justify the need for changes in classroom instruction when he confers with teachers.

The 4 through 12 principal and teachers were pleased with their progress. The principal mentioned seeing more hands-on activities in classrooms and seeing "students excited about learning." Teachers reported teaching more hands-on lessons. Several also said that they have used the activities included with the framework. (A 1995 Addendum to the 1994 framework document is made up of sample lessons in math and science for different school levels.) Teachers also referred to new ways of teaching and learning. Two middle-level teachers were pleased that they did not have to be the only "teachers," since their students were also learning from each other with the new activities. Students, according to these teachers, liked being more in charge of their own learning and the discovery process. Students also knew that "it's all right to fail if you learn." During our observation of a lesson on body systems, one student suggested that this was just like the

checks and balances system in government (a recent history topic for the class). Another student commented that they did science during math class that morning. A discussion occurred about relationships and how things work together. High school teachers at Farmville School are not as involved with the frameworks as their middle-level colleagues, but they did mention using more hands-on and cooperative learning strategies in mathematics and science.

The impact of the frameworks in this district was most evident in the curriculum revisions and in the teachers who have been active participants in workshops and other professional development opportunities related to the frameworks. The 4 through 12 principal believed that the framework was an excellent guide for their curriculum and was pleased with the integration and alignment of the curriculum that resulted from the revision process. Frameworks, in his words, "opened up information teachers didn't have at their fingertips." The high school math teacher credited the framework with getting people to take workshops that they might not have attended otherwise. He also mentioned the ties between math and science that are now in place in the curriculum. When teachers look for textbooks, according to several respondents, they compare the content with the frameworks.

In this small town, the district's use of frameworks was more individualized and less planned than Parkside's. Although district officials argued that their revised curriculum was evidence of effective framework use, classroom-level implementation was uneven.

Red Ridge, Arkansas: Frameworks as a Distraction

The Red Ridge School District serves about 2,800 students. The district has five elementary schools (K-4), one middle school (grades 5-6), and one high school or "secondary complex" (grades 7-12). The Red Ridge area has traditionally been a manufacturing center with low-wage, low-skill jobs. More recently, new industry that requires more skilled workers has moved to the region. District officials saw the need to equip students with better mathematics and science skills so that they could graduate qualified for college or the better-paying, high-skill jobs.

Red Ridge had a reputation as a progressive and innovative district with a dynamic superintendent. Much of its reputation stemmed from the host of brand-name reforms under way in the district. The district was involved with New Standards, Schools for the 21st Century, the Coalition of Essential Schools, and one of the New American Schools

initiatives. Individual schools also focused on a variety of curricular and other reform ideas. District officials worried about the overload of reform initiatives, but found it easy to get new grants once the first one was won. The following case describes one of the more reform-oriented schools in the district.

Exhibit 17

REFORM WITHOUT FRAMEWORKS

Meadows Elementary School

Meadows Elementary School is located next to Meadows Middle School about 3 miles from downtown Red Ridge. It consists of a small central school building and portable classrooms, a gymnasium, and a new cafetorium. The school sits on 30 acres of land, surrounded by small farms. It serves about 360 students in grades K-4 with 25 teachers, 2 aides, a guidance counselor, and a librarian.

The hallways of the school were decorated with various environmental scenes: the desert, the mountains, Arkansas, and the ocean as part of the schoolwide "Regions of the Earth" theme. The displays included items found in each region, a large mural, and, in some cases, tape-recorded sound effects. Most of the classrooms were equally colorful, with lots of displays of children's work and evidence of a theme-based approach. The schoolwide themes included: Our Heritage, Arkansas, Pioneers, United States Geography, Science Fair, Regions of the Earth, and the History of Our County. The school had a welcoming and child-centered feel to it.

The principal seemed to be a strong and hard-working leader. She has devoted much of her time and energy to acquiring special funding for the professional development of her teachers. She drove van loads of teachers to Kentucky to observe schools. She found funds to fly teachers to national conventions and to exemplary schools as far away as Vancouver, BC. Another group of teachers were sent to Cincinnati to observe classes with multi-age grouping.

The Meadows School brochure listed an incredible array of programs, including 12 special instructional programs [accelerated reading, Box It Bag It Math (an extension of Math Their Way), developmental kindergarten, Sing Spell Read Write, Shurley Method, Success in Reading, K-4 Crusades, etc.]; 16 service programs (mentoring programs, drug education, summer enhancement, parent volunteers, positive action program, Reading is Fundamental, Wee Deliver, etc.); 8 learning environment programs (cooperative learning, whole language, thematic units, literature-based reading, hands-on manipulatives, peer tutoring, teacher teams, etc.); and an outdoor environmental laboratory, Project MAST pilot school, and Partners in Education (business partnerships).

Exhibit 17 (Concluded)

On top of all this reform activity, the state's new curriculum frameworks arrived in the district. Two of the school's teachers volunteered to serve on the district committee to revise the curriculum on the basis of the framework. Unfortunately, the experience failed to bring any coherence to a clutter of projects and reform initiatives, and they expressed frustration with the committee's work.

In Red Ridge, the Arkansas mathematics and science curriculum frameworks got lost among the many reform initiatives. Like other districts in Arkansas, the state department of education asked Red Ridge to revise its district curriculum in light of the new state frameworks. Red Ridge organized a committee of teachers representing all grade levels. The committee received samples of revised district curriculum guides from districts that were supposed to have piloted the new frameworks. However, the sample guides were essentially long lists of textbook pages associated with the various strands of the framework. The committee broke into elementary, middle, and high school subcommittees, who were charged with revising the district curriculum guide for their grade levels. The elementary school group completed an extensive document; the middle and high school groups took the task less seriously, completing only one page each. District officials reported that the eventual result was that the framework activity was just a distraction. They also pointed to districts that revised their district curriculum by photocopying one from a neighboring district.

During this period of active reform in the district, students' test scores on the Stanford-8 Achievement Test dropped, while less innovative neighboring districts' scores were going up. District officials argued that the neighboring districts were teaching to the test. In addition, they decided that teachers were spending too much time out of the classroom in professional development. As one district administrator declared, "It concerns me very much that a generation of kids are sitting in class with a sub rather than a certified teacher." Most teachers argued that the tests simply did not measure what they were teaching in their classrooms. The district is trying to continue its reform orientation, but public pressure to boost the test scores is strong. District officials hope that their students will fare better on the new state assessments.

Cross-Cutting Themes

Translating State Frameworks into Local Documents

All five cases, Gemtown, Cutler City, Parkside, Farmville, and Red Ridge, reflected a pattern of activity common all across the country. It appears that every level of the system is involved in creating frameworks or guides based on standards. On the face of it, this emphasis on document production seems redundant. Yet we found some genuine benefits to these activities, as well as a few challenges. As we reported in previous reports, those who participated in the creation of the state curriculum frameworks seemed to derive the most benefit. Given that fact, a certain degree of redundancy may have been a necessary price for wider participation in standards-based reform. Of course, as the Red Ridge case illustrated, local standards development can be poorly done. Still, our district cases support the view that professional practice can improve when teachers and others are involved in production of local standards.

Experience with Reform

The examples of Gemtown and Cutler City, our best-case scenarios, provide further insight into the effective use of frameworks. Both districts and the highlighted schools engaged the standards documents from a foundation of previous reform activity. The Gemtown district was particularly active in a districtwide strategy for change. At the same time, the Smithson Elementary School was well on its way to schoolwide reform when the teachers began to use the standards documents. In both cases, the teachers were not confronted with unfamiliar concepts when they began studying the documents. For example, at Smithson we observed a workshop designed to introduce standards and heard a collective sigh of relief as teachers began reading the documents.

Whole-School Change, Collegiality, and Professional Development

In addition, our best-case scenarios point to the importance of whole-school change as a supportive condition for effective use of the frameworks. In these cases, teachers were able to experiment with the ideas suggested by the framework in a collegial and professional atmosphere. Teachers served as resources to each other and worked together on projects. In addition, the school culture supported the idea of learning as a collective endeavor.

Professional development activities designed to help teachers use the state frameworks in Gemtown, Cutler City, Parkside, Farmville, and Red Ridge varied widely

in duration, intensity, and coverage. Of the three districts just beginning to use standards, Parkside teachers obviously had the most intensive and extensive opportunities to use the frameworks. Whereas Parkside required every teacher in the district to serve on one of the content-area subcommittees, Farmville and Red Ridge teachers' participation in framework-related professional development was completely voluntary. One result was that Farmville's high school teachers were not very involved with the frameworks or the district's efforts to revise curriculum. In Red Ridge, a select group used the frameworks—only those teachers on the revision committee and those teachers introduced to the frameworks through professional development opportunities outside the district.

In our best-case scenarios, continuing professional development opportunities were abundant and increasingly focused on standards. Linking professional development to framework and standards documents helped bring coherence and direction to teachers' professional growth. Although teachers could have used more time during the regular school day to plan, study, and reflect, professional development was a routine part of teachers' work. In Gemtown, the district built incentives for continuing professional development into the teacher contract. At Smithson School, the teachers played a central role in the planning of their own professional development.

As recent research on instructional reform concludes, the reform messages transmitted are not necessarily the messages that teachers receive or act on in practice (Spillane & Jennings, 1997). Even in the more comprehensive professional development strategy under way at Parkside, the teachers had not had enough time to use and reflect on the standards to consistently incorporate the ideas into their practice. Clearly, they were not as far along as the teachers in our best-case scenario districts. Even in the Gemtown district and the Smithson School, the teachers recognized that deep changes in their teaching required continuing professional growth.

Although our cases underscore the importance of including intensive, ongoing professional development as part of the cost of operating a school, none of the sample districts were particularly well funded. Professional development remains vulnerable to budget cuts. Beyond limited resources, the districts were only beginning to explore ways to build professional development into the structure and organization of the school day. In Cutler City, teachers in a middle school not far from Smithson recently devised a school schedule that allowed core teachers 2 hours of common planning time each day.

Although the school principal supported the plan, the district balked, not wanting to set a precedent.

Adaptation vs. Adoption

In each of the five cases, districts adapted the standards and framework documents rather than adopted them. Local districts will inevitably adapt guidance from the top of the system to suit local conditions, but in our best-case scenarios the schools and the teachers had the capacity to add value to the guidance during the adaptation process. In the Gemtown district and the Smithson School, long-term experience with standards-based reform, extensive professional development opportunities, and an evolving professional culture helped create high-capacity organizations able to use the framework well. Thus, these cases suggest that reformers at the top of the system are always dependent to some degree on reformers at the bottom of the system—suggesting that capacity building is a key to successful implementation.

Content vs. Pedagogy

Although there are clear benefits to involving large numbers of teachers and administrators in the production of standards-based documents, there remain some unresolved issues. First, our district cases suggest that local involvement with state frameworks emphasizes content over pedagogy. Much of the work of the various curriculum committees, study groups, and workshops involved translating the state frameworks into grade-by-grade local curriculum guides with few references to teaching strategies. Only in schools like those highlighted in the first set of cases, Bradley and Smithson, did we note intensive teacher attention to both content and pedagogical issues. In both cases, the school climate supported teacher conversations about such pedagogical issues as teacher attitudes and behaviors, teaching style, classroom management in an activity-oriented classroom, developing and using performance assessments for instructional purposes, and attending to cultural differences among students.

The imbalance between the need for changes in both what is taught and how it is taught stems, in part, from states' reluctance to offer guidance on pedagogical issues. Even in states that produced framework documents with extensive pedagogical guidance, it was not always easy to get districts to pay attention. For example, Massachusetts' highly regarded state curriculum framework includes a first chapter (separately bound) that discusses pedagogical issues that are common to all of the disciplines, and six chapters devoted to English/language arts, mathematics, science and technology, history

and social studies (currently under review), the arts, and health. Our informants reported that in high schools and middle schools the discipline chapters were sometimes handed out to the appropriate discipline teachers, but no one received the common chapter.

Assessment and Accountability

Each of the cases suggests continuing challenges for standards-based reform for even the most positive cases. Although our best-case scenarios described schools that had improving test scores, teachers were still struggling with the sometimes conflicting purposes of assessment. On the one hand, teachers were trying to devise their own assessments for instructional purposes and found the task challenging and time consuming. On the other hand, the existing state assessment systems in both New York and Massachusetts were not yet well aligned with the state frameworks. Both states are developing new assessments, but teachers felt pressure to devote more attention to tests with accountability purposes than to tests with instructional purposes. The technical challenges involved in large-scale assessment make it uncertain whether the new assessment systems will be able to resolve this dilemma for teachers.

A Remaining Challenge

As the five cases suggest, standards-based reform has captured the attention of many professional educators who are trying to improve mathematics and science education. However, as we indicated earlier and saw again in the five cases, standards-based reform has been primarily a professional, not a public, activity. This lack of public involvement with standards is a problem because, regardless of their effectiveness, reform leaders—from the superintendents to the principals—were vulnerable to shifts in public opinion and the political composition of the local school boards. Without stronger public support, even the most promising reform efforts could be scuttled.

Although the public seems to approve of the concept of standards for student performance, public understanding of the standards has been superficial, at best. Even in our best-case scenarios, parents that we interviewed expressed support for the work of the schools but little understanding of the standards that were guiding that work. In both of our best-case scenario districts, efforts were under way to familiarize parents and the wider public with the standards, but these efforts tended to be one-way information sessions. Just as teachers and administrators in the 5 cases and the 17 districts we visited enhanced their understanding of standards and frameworks by using them to create local curriculum documents, parents and the public are also likely to need more than brief

introductions. Particularly at the school and district levels of the system, there are significant opportunities to engage parents and the many publics, in partnership with teachers and administrators, in the hard work of defining what children should know and be able to do.

As one observer noted several years ago: "Whether standard setting at any level of government can foster improvements in the education of the nation's children will depend on the quality of debate standard setting engenders. More specifically, it will depend on whether such debate can help to educate the public about education and, beyond that, assist in mobilizing greater interest, appreciation, and concrete support" (Lagemann, 1995). This is a different measure of success than is typically associated with standards-based reform. Like the participants in the framework projects, reformers defined success as increased school effectiveness and higher student performance. The implicit assumption is that if the schools are improved, public support will take care of itself. But, as another commentator pointed out recently, the public schools are at risk because they have lost their legitimacy, not just their effectiveness. "Institutions face a loss of legitimacy when those who created them no longer believe that the institutions are their agents, acting on their behalf. . . . Like a crack in the foundation of the public school system, the lack of legitimacy is a structural defect that undermines all the good work to make the schools more effective" (Mathews, 1997).

The standards-setting efforts we found in our sample of local districts have engaged some educators focused on school effectiveness, but not on issues of legitimacy. Although professional educators are making well-motivated efforts to boost expectations and improve student performance, the public debate is about charter schools, choice, and vouchers. The public is increasingly convinced that nothing short of a major overhaul of the system will do the job. One recent survey reported that 56 percent of the public believed that the schools had completely failed or that they should be overhauled (Belden, Breglio, Kernan-Schloss, & Plattner, 1997).

For standards-based reform to succeed, reformers must simultaneously address issues of public school effectiveness and legitimacy. To that end, standards setting needs to be more than a professional activity, and it must involve the parents and the various publics in addressing such difficult issues as: "How do we ensure that all children meet the standards?" "What is the proper balance between teaching the basics and promoting higher-order thinking?" "What gets left out of the curriculum if we replace breadth with depth?"

Engaging the public in standards-based reform efforts will not be easy. Educators are much better at walling off the public from "professional" concerns than engaging the public. Only by broadening participation and broadening the debate can standards-based reform begin to address both effectiveness and legitimacy. As Robert Bellah and his associates (1991) pointed out, the pressing question for American government "is not just what government should do but how it can do it in a way that strengthens the initiative and participation of citizens, both as individuals and within their communities and associations, rather than reducing them to the status of clients." Meaningful public engagement is a remaining challenge for standards-based reform if it is to last and if it is to matter.

Conclusion: Standards-Based Reform at the District Level

We began this chapter with the caution that it was still too early to see widespread changes in policy and practice at the district level. The districts that we have described in this chapter, along with the others that we visited, reflect localities that have been using their states' frameworks. State officials are confident that other districts are beginning to be actively engaged in standards. They insist that the states' curriculum frameworks will become increasingly important as new assessment systems are introduced or as the professional development in the states becomes more consistently focused on standards. Other recent studies support this view. For example, the 1997 CPRE report *Persistence and Change: Standards-based Reform in Nine States* found that "half of the districts located in states with standards in place reported that the standards initiatives had influenced their own instructional guidance efforts" (Massell, Kirst, & Hoppe, 1997).

The majority of the district cases paint a fairly positive picture of what happens to framework documents once they reach the school districts. At the same time, the cases underscore the amount of time and resources needed to use frameworks well. At Bradley and Smithson, teachers had a solid foundation of reform experience, good leadership, and adequate resources that allowed them to use the framework and standards documents in meaningful ways. In both schools, this foundation was built over time.

Even with a solid foundation, schools and districts must confront a large number of issues if standards-based reform is to mature and result in systemwide improvements. We pointed to the challenges teachers faced in trying to balance the accountability and instructional purposes of assessment. To the extent that new assessment systems encourage teachers to prepare students for the new tests in old ways, the new assessments may only reinforce a culture of testing and tracking. We also argued that meaningful

parent and public engagement with the standards is a largely unaddressed challenge for standards-based reform. As the cases make clear, effective local standards-based reform requires significant amounts of time and resources. The effectiveness of standards-based reform will depend on how well a public debate about what students should know and be able to do translates into a public commitment to provide what it takes to allow all students to meet those expectations.

In the concluding chapter, we will review the major findings of the study and discuss the implications of those findings for the federal strategy.

VIII. CONCLUSIONS

This final report has used findings from the evaluation of the 16 state curriculum framework projects to better understand the implementation of standards-based reform at the state and district levels. In this concluding chapter, we summarize the findings of the report and discuss implications of the findings for the federal efforts to promote high standards for all students.

Summary of Findings

As is the case in the vast majority of states, all 16 states that received curriculum framework grants were actively engaged in standards-based reform. Even in those states where the framework projects ran into trouble, state officials and policy-makers were busy reviewing and revising policies and programs under the banner of standards. The robustness of standards-based reform helped make the projects' curriculum frameworks useful resources to the states. Fifteen of the 16 projects completed curriculum frameworks in mathematics and/or science.

The projects devoted less time and resources to the project's other components: model guidelines for teacher education and certification, criteria for teacher recertification, and model professional development. As a result, the projects were unable to meet the full expectations of the original solicitation. The projects' uneven progress on these other products was caused by the unrealistic assumptions of the original solicitation and aggravated by the projects' emphasis on framework development.

The projects' framework development process typically involved large numbers of educators in the writing, review, and revision of documents. Framework development required educational expertise, but the process also encountered political issues. In adapting to each state's political context, the frameworks avoided violation of local-control sensibilities and other politically contentious issues. In the end, framework development was a professional, rather than a public, activity.

A review of a sample of framework documents by outside experts found that although the frameworks acknowledge the influence of the national standards, many documents omit major content categories or rewrite particular standards in such general language that the original meaning is lost. The reviewers did cite some exemplary features of specific documents but were critical of many of the sample activities, the use

of jargon, and the lack of guidance on equity issues. Our subsequent review of local standards documents found great variation among the local attempts to align their curriculum guides and local frameworks with the state frameworks.

Our examination of the frameworks' role in state policy revealed that states were actively engaged in two key policy areas, assessment and teacher licensure, with or without the help of the projects' frameworks. Fourteen of the 16 states were actively developing new assessment systems. However, only 10 of the 16 states used the projects' frameworks to develop these systems. Similarly, 9 of the 16 states had implemented or were developing new teacher licensure policies; 6 of these states used the projects' frameworks to develop such policies.

The 16 project states employed a variety of strategies to use the frameworks to help improve teacher practice. All states used framework-based professional development as a primary strategy. Some projects recognized the need for additional support materials and the value of linking the frameworks to other resources and other initiatives. States' other strategies included the use of technology and the creation of pilot sites.

Our examination of the use of frameworks in a sample of districts and schools found that production of local standards can be a meaningful professional development activity. Effective use of frameworks was enhanced by previous experience with reform, whole-school change that helped create a collegial and professional school culture, and extensive and intensive professional development opportunities focused on standards.

The cases also underscored the fact that districts and schools adapted rather than adopted standards and framework documents. The standards can be weakened during the adaptation process, but in our best-case scenarios the schools and the teachers had the capacity to add value to standards.

The district cases also revealed that frameworks were used to address content issues far more than pedagogical issues. In addition, teachers in the districts were struggling to balance the accountability and instructional purposes of assessment. Finally, the district cases suggested that a remaining challenge for standards-based reform is better public understanding of standards and subsequent support for the resources necessary for all students to meet the standards.

Implications for Federal Efforts to Promote Standards-Based Reform

Fourteen years after *A Nation at Risk* and 8 years after President Bush and the nation's governors settled on the National Educational Goals, the so-called standards-based reform movement seems to have remarkable staying power. The State Curriculum Frameworks Projects have provided support for that movement in 16 states. The majority of the project states are using the frameworks to revise key education policies, a clear contribution of the federal support. The impact of the projects is likely to continue as the frameworks are used by local districts and other ongoing initiatives.

Frameworks can serve as general policy guidance and can be useful to local districts in their reform efforts. Although federal funds lent support to standards-based reform in the states, each state's political and educational context dictated what role the projects would play in the reform effort. In addition, the projects' efforts on the other products revealed that teacher education, certification, recertification, and professional development policies involve a variety of interested parties and contentious political issues that are unlikely to be guided by theoretical documents produced in isolation from those parties. The projects' uneven efforts to develop model professional development programs, model guidelines for teacher education and certification, and criteria for teacher recertification also suggest a need for future ED grants to be based on a more realistic set of assumptions and a more reasonable scope of work.

Much more work is needed before the curriculum frameworks will be well used in a majority of districts and schools. As our case study districts suggest, capacity building is a key to successful implementation. Districts and individual schools need more time and resources to translate the state frameworks into local curricular guidance, a process that makes the standards more meaningful.

Given the need for capacity building at the local level, the inevitability of local adaptation, and the difficult issues facing teachers and administrators as they try to use standards to guide their practice, federal support for standards-based reform is most needed at the local level. Clearly, federal support through Goals 2000, the Eisenhower Professional Development Program, and other federal programs is already playing a role, but far more time and resources are needed than are currently available in most schools.

Federal support for further curriculum framework development at the state level is unlikely, and probably unnecessary, but our research makes it clear that teachers and administrators can benefit from using the state curriculum frameworks to revise local curriculum documents and reflect on their practice. Unfortunately, most schools lack the

resources to provide adequate time for teachers to undertake such work. Making the standards more meaningful and understanding the implications of the standards for teaching cannot be done quickly and cheaply, and building public support for standards cannot be done from Washington, DC. Federal support for local implementation of standards would build on the work of the State Curriculum Frameworks Projects and help expand the number of schools that are using standards to create fundamental changes in the way they work.

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Appendix A

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Appendix B

Reviewers and Procedures

EVALUATION METHODS

In June 1994, SRI produced the *Study of the Dwight D. Eisenhower Mathematics and Science Education State Curriculum Frameworks Projects and Regional Consortiums Program: Study Design and Data Collection and Analysis Plan.* That document presented a theoretical framework for the evaluation, the study's key research questions, and a detailed description of evaluation methods. In addition, the document included our data collection instruments, including case study guides and tailored topic guides for semistructured interviews. In this appendix, we present the research questions and summarize the data collection activities.

Research Questions

The original research questions that guided the study are presented in Exhibit B-1.

Exhibit B-1

RESEARCH QUESTIONS FOR THE STATE CURRICULUM FRAMEWORKS PROJECTS

Organization and Development of the State Curriculum Frameworks (SCF) Projects

- How well did the SCF projects complement other significant education reform efforts in the states?
- What is the relationship between SCF projects and other systemic initiatives in the state?
- What state characteristics promoted successful SCF project activities?
- How did activities in states with Curriculum Framework grants differ from states without these federal grants? What difference did the federal support make?
- How did the development of curriculum frameworks in mathematics and science differ from the development of frameworks in other disciplines in the states?
- How did the distribution of resources vary across the SCF projects?
- How did the process of developing curriculum frameworks vary across states?
- Who was included in the development of the curriculum frameworks? Who was excluded?
- How did the states balance the need for expertise in the development of curriculum frameworks and the need for broad participation in the implementation of the frameworks?
- How successful were SCF projects at building consensus about mathematics and science education reform? How widespread was participation in the projects?

State Curriculum Frameworks Projects Products and Services

- How did the states define a curriculum framework? How do the curriculum frameworks differ between the states?
- How many states developed curriculum frameworks and completed their other activities? What were the major barriers?
- Was there any organized resistance to the development of curriculum frameworks or other SCF project activities? What is the position of those in opposition?
- Where did the ideas for the specific design of the curriculum frameworks and other related initiatives come from? Did the states use existing frameworks as a guide?
- What is the extent and impact of assistance and collaboration between the SCF projects and the Regional Consortia?
- Are the states' assessments, teacher preparation and accreditation, textbook adoption policies, staff development, and technology policies aligned with their curriculum frameworks?

Quality and Effectiveness of the State Curriculum Frameworks Projects

- To what extent are the frameworks and framework-related activities consistent with emerging national standards in mathematics and science education?
- Which SCF project activities contributed to improvements in mathematics and science education? Which were less successful?
- What evidence exists to suggest that completed curriculum frameworks and other policy changes are being implemented?
- How have the SCF projects promoted changes in state and local policies affecting mathematics and science education?

Data Collection Activities

Data collection activities over the course of the 4-year study (1993-1997) were timed to maximize our understanding of both the development and implementation of the projects' products. During the 2nd, 3rd, and 4th years of the study, data collection activities included:

- Review of State Curriculum Frameworks Projects documents, including original proposals, continuation proposals, draft and completed frameworks documents, and draft and completed documents from model guidelines for teacher education and certification, criteria for recertification and model professional development, and available evaluation materials.
- Review of state data from a variety of secondary sources (see complete list of sources in Appendix A).
- Telephone interviews with project directors, state officials, SSI directors, Eisenhower state coordinators, and key participants.

During the 2nd and 3rd years of the study, we also worked with a group of outside educational experts to evaluate the quality of the framework documents. In addition, we conducted 2-day site visits to four states (Florida, Louisiana, Nebraska, and Oregon) during the 3rd year of the study. In the 4th year of the study, we conducted more intensive week-long site visits to 8 of the 16 states. Those site visits included in-depth interviews with state officials as well as teachers and district officials in a sample of two to three districts in each state. Exhibit B-2 summarizes the evaluation's data collection activities.

Exhibit B-2

DATA COLLECTION ACTIVITIES

State	1996 Site Visit	1997 Site Visit	Document Review and Telephone Interviews (1995-97)	Expert Review	Site Visits through Other Studies*
Alaska			X	X	
Arizona			X		
Arkansas			X	X	SSI
Delaware		X	X	X	SSI, Pew
District of Columbia			X		
Florida	X	X	X	X	SSI
Louisiana	X	X	X	X	SSI
Maine		X	X	X	SSI
Massachusetts		X	X	X	SSI
Michigan		X	X	X	SSI
Nebraska	X	X	X	X	SSI
New Jersey			X	X	SSI, AAAS
New York			X		SSI, Pew, AAAS
Oregon	X	X	X	X	Pew
Rhode Island			X	X	SSI
Wisconsin			X		

*SSI = Statewide Systemic Initiative (National Science Foundation)
Pew = Pew Network for Standards-Based Reform (Pew Charitable Trust)
AAAS = American Association for the Advancement of Science's Project 2061

Document and Secondary Source Review

Document and secondary source review was an important part of the data collection activities. A complete list of documents and secondary sources was prepared by SRI and

included in an April 1997 report to ED entitled "Document Lists, Telephone Interview Records, and Selected Indicators." Sources and documents related to the State Curriculum Frameworks Projects are included in Appendix A.

We gathered successive drafts of framework documents and thereby understood how these frameworks were developed and revised in different states. We also collected state documents and other materials that influenced the frameworks (or from which the frameworks represented a significant departure). Typically, these were state curriculum guides or lists of goals and objectives for mathematics and science. Examples of additional documents included:

- Guidelines and criteria for teacher certification and recertification.
- Lists of curriculum standards in mathematics, science, and other disciplines.
- Newsletters from framework projects to educators in the state.
- State assessment system overviews and sample items.
- Position papers from professional associations of mathematics and science educators on teaching, learning, professional development, and other topics.
- In-state evaluations of framework projects.
- Framework-based professional development materials (including professional development models).

These documents were a rich source of background information on the states and their framework projects. In addition to helping members of the study team understand the development of the frameworks, the documents we reviewed enabled us to provide better support to the expert panel as they assessed the quality of selected framework documents. (The methods followed in assessing framework quality are described below.)

Telephone Interviews

Telephone interviews were conducted annually with key informants in the states and were guided by a semistructured list of interview topics. We wanted to gather comparable information from year to year and across framework project states, so the same overall topics were explored in each interview. We also wanted to understand the individual characteristics of each project, so the topics were sufficiently open-ended to capture the full detail of framework projects in different states.

State-level respondents to the telephone interview always included the framework director or the equivalent person within the state department of education or other

sponsoring agency (Rutgers University, in the case of the New Jersey project). In cases where the math and science framework efforts were headed by different people, we spoke with both. Our interviewees included:

- Project director
- Evaluator
- Advisory committee members
- Participants in the projects
- Eisenhower state grant coordinator
- SSI principal investigator
- State math and science coordinator
- Other key informants.

Interviews with the State Curriculum Frameworks Project directors lasted approximately 60 minutes; interviews with the other informants ranged from 20 to 40 minutes. All members of the evaluation team participated in a 1-day training session to review the study design and discuss the interview topic guides and case study guides. In addition, all evaluation team members received detailed memos before each round of data collection, reviewing interview procedures and highlighting issues of importance to the particular phase of the study. Although our original data collection plan called for interviews with only 10 project directors in Year 4 of the evaluation, all 16 directors were interviewed.

Site Visits

Using sampling criteria described in *Study Design and Data Collection and Analysis Plan*, we conducted two rounds of site visits. As we indicated in Exhibit B-1, we conducted site visits in Delaware, Maine, Massachusetts, Michigan, Florida, Louisiana, Nebraska, and Oregon. We visited the latter four states in both years 3 and 4 of the evaluation. Year 3 site visits consisted of 2 days on-site; year 4 site visits consisted of 4 to 5 days on-site.

The purpose of these site visits was to gather richer data by means of face-to-face interviews and to increase the number of interview respondents. Even though we are satisfied with the quality of the data collected in the annual telephone interviews, we also believe that the additional effort devoted to the case studies enabled us to explore common themes in considerable detail and to uncover new ones. For example, our most

systematic exposure to the use of frameworks by local educators occurred during case study visits to states and school districts in years 3 and 4 of the study.

The interview protocols used in the case studies were based on the same pool of topics and subtopics as the telephone survey interview guide. In fact, the state-level instruments were the same. Additional interview protocols were developed for school- and district-level interviews. State-level respondents included the following:

- State Curriculum Frameworks Project director, evaluator, and selected committee members.
- Eisenhower state grant coordinator.
- Statewide Systemic Initiative (SSI) principal investigator, if any.
- Chief state school officer or representative.
- School district officials, administrators, or teachers active in the project at the state-level.
- Representatives of participating institutions of higher education (IHEs).

The length of the interviews depended on the familiarity of the informant with the project. For example, interviews with the project directors typically lasted 2 hours and involved interviews at the beginning and end of the site visit. Interviews with the Eisenhower state grant coordinator typically lasted only about 30 minutes.

Interview topics consisted of the following:

- State context (the education system, educational reform, and the place of the State Curriculum Frameworks Project).
- Planning, development, and implementation of each component of the project.
- Quality and impact of each component of the project.
- The State Curriculum Frameworks Projects' role in the federal strategy.

Topic guides were designed to allow the interviewer the flexibility to capture the unique contextual issues in each state, but were specific enough to see that comparable data were gathered across all states.

Local Case Studies

Within the 8 case study states, we visited 17 school districts. These districts were selected because they represented places where at least one of the following conditions was present:

- State frameworks and/or standards were being implemented.
- Local educators participated in the development of the state framework and/or standards *and* served as professional development contacts for others.
- Local curriculum reform or reform orientation was aligned with or exceeded state-level initiatives.

State officials identified these districts for us, in most cases. Our visits to local districts lasted 1 day. During our local visits, we interviewed district administrators (superintendents and associate superintendents for instruction) and subject area specialists in math and science. At schools, we interviewed principals and teachers. Teachers were interviewed individually or in groups, depending on their availability at the time of our visits. Interviews with teachers were preceded by brief observations of their teaching, when possible. All interviews lasted approximately 40 minutes.

We had two main goals for our district interviews. First, we wanted to understand district perceptions of the State Curriculum Frameworks Project, other state reforms, and the state context generally. Second, we wanted to gauge how the state framework was used and adapted to local circumstances. The local interview questions addressed these goals through the following topics:

- State context.
- If applicable, local participation in framework planning, development, and implementation at the state level.
- Local perceptions of the quality and impact of each component of the project.
- Local context and local reform efforts.
- Local dissemination, implementation, and impact of the framework project.

At the school level, we wanted to understand how teachers and building administrators confronted state and local reforms. We were also interested in what kinds of professional development opportunities were available to teachers and whether these opportunities were consistent with the frameworks and standards-based reform agendas of the state and district. As in the case of district respondents, some building-level educators participated in state-level development and implementation of the framework projects. We covered the following topics in our school-level interviews:

- School context.
- School perceptions of state and district context.
- Overall vision and goals for the classroom.

- The state curriculum framework (the writing process, if applicable; quality; exposure to framework-based professional development).

Collaboration with Other Studies

The evaluation team was able to leverage data from other related studies conducted by SRI and its partners. We purposefully designed the data collection activities to take advantage of the national evaluation of NSF's Statewide Systemic Initiatives (SSI), the evaluation of the American Association for the Advancement of Science's Project 2061, the evaluation of the Pew Network for Standards-Based Reform, and the analysis of the quality of curriculum frameworks carried out by the Council of Chief State School Officers. This coordination resulted in benefits and significant additions to the data collected through this contract's funds. First, our coordination efforts allowed us access to internal case study reports on 10 of the State Curriculum Frameworks Projects that were located in states that also had SSIs. These case studies were particularly valuable because all SSI researchers had been trained to include questions about curriculum frameworks in their interviews. The coordination efforts also took advantage of overlapping staffing among the studies, allowing some members of the study team to visit states (via the SSI evaluation) that were not among our eight-state sample, as well as districts (via the Pew evaluation). Our coordination efforts with the CCSSO study allowed for the use of an important analysis of a sample of existing frameworks, as well as baseline data on frameworks in all 50 states and the District of Columbia. Exhibit B-2 illustrates which states we were able to visit as a result of other studies.

Assessing Quality

To assess the quality of the projects' curriculum frameworks, we convened a distinguished group of experts. A complete list of participants follows this brief discussion. The expert reviewers met two times in Washington, DC, to assess the quality of the projects' curriculum frameworks. The first meeting was held in January 1994, and the second meeting was held in February 1996. In addition, many of the same group of reviewers met in Madison, Wisconsin, in the summer of 1994 and 1996 to assess the quality of frameworks from both project and non-project states. The first meeting was designed to establish the criteria by which to judge quality. The result was 11 elements for analyzing curriculum frameworks. Approximately 1 month before the panel convened to complete the analysis in each of the subsequent meetings, each member received three states' mathematics or science curriculum frameworks and a set of Curriculum Framework Analysis Questions that guided their document review. The

analytic questions were derived from the 13 elements the reviewers had established in their first meeting in January 1994. Both the analytic questions and the elements are included below.

We encouraged panelists to base their reviews on the analytic questions and to refer to the *National Science Education Standards*, *Science for All Americans*, *Benchmarks for Science Literacy*, and the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics*. Panelists came to the meeting having completed detailed analyses of the three frameworks assigned to their working group. At the meeting, four groups of five or six panelists and research team members conducted the analysis. Members shared their observations about the frameworks, using the project's analytic questions as a discussion guide. The research staff provided the working groups with information about the context within which each framework was written, based on information we obtained from extensive interviews with state officials in preparation for this meeting. Following a period of discussion, each working group drafted a consensus commentary on its assigned frameworks that reflected the views of the working group. The research team raised clarifying questions about each review, and the reviews were revised one more time. After completing the individual state reviews, the reviewers explored cross-cutting themes that emerged from their reviews.

In addition to assessing quality features of the curriculum frameworks, the reviewers summarized what they regarded to be cross-state issues and policy implications for the federal government's continuing support of state systemic reforms in elementary and secondary school mathematics and science education. Key ideas and issues were further developed on the third day of the meeting by a small group of reviewers and staff.

SRI International
Council of Chief State School Officers
Policy Studies Associates
Expert Panel Meeting on Analysis Design for
State Curriculum Frameworks in Mathematics and Science

Participants, January 26-28, 1994
Washington, DC

Panel Members
Walter Secada (Panel chair), Mathematics Education, University of Wisconsin-Madison
Charles Allan, Mathematics Specialist, Michigan Department of Education
Joan Baron, Student Assessment, Connecticut Department of Education
Rodger Bybee, Biological Sciences Curriculum Study, and NRC Science Education Standards
Iris Carl, past president, National Council of Teachers of Mathematics
Donald Chambers, Mathematics Education, University of Wisconsin-Madison
Douglas Christenson, Deputy Superintendent, Nebraska Department of Education
Curtis McKnight, Mathematics, University of Oklahoma
Celeste Pea, Science Specialist, Louisiana Systemic Initiative
Senta Raizen, Chemistry, and Director, National Center for Improving Science Education
Andy Reeves, National Council of Teachers of Mathematics
Charles Warren, Science Specialist, Ohio Department of Education

Ex Officio
Susan Gross, National Science Foundation
Nancy Loy, U.S. Department of Education
Charles Stalford, U.S. Department of Education

Study Staff
Rolf Blank, CCSSO, Study Director
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Camille Marder, SRI International
Andrew Zucker, SRI International
Bruce Haslam, Policy Studies Associates
Ellen Pechman, Policy Studies Associates

SRI International
Council of Chief State School Officers
Policy Studies Associates
Meeting on State Curriculum Frameworks in Mathematics and Science

Participants, February 14-16, 1996
Washington, DC

Reviewers
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Douglas Archbald, School of Education, University of Delaware
Margaret Bondorew, Mathematics Education, Northeastern University, Massachusetts
Donald Chambers, Mathematics Education, University of Wisconsin-Madison
Audrey Champagne, Science Education, SUNY-Albany
Benjamin Dixon, Deputy Commissioner, Connecticut Department of Education
Charles Doyle-Warren, Science Supervisor, Forest Hills School District, Cincinnati, Ohio
Lynn Gatto, Science Teacher, Rochester, New York
Martha Green, Science Specialist, Florida Department of Education
Susan Gross, Montgomery Co. Schools, MD
Brenda Hammond, Mathematics Teacher, Montgomery County, Maryland, Schools
Andrea Keim, Curriculum Frameworks, South Carolina Department of Education
Curtis McKnight, Mathematics, University of Oklahoma
Celeste Pea, Science Specialist, Louisiana Systemic Initiative
Harold Pratt, Biological Sciences Curriculum Study, Colorado
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Patrick Shields, SRI International
Viki Young, SRI International
Katrina Waiters, PSA

Guests
Norm Webb, Consultant, Univ. of WI-Madison
John Barth, NGA
Ken Nelson, NEGP
Alice Gill, AFT

ELEMENTS FOR ANALYZING STATE CURRICULUM FRAMEWORKS

At the end of January 1994, an expert group composed of state education staff, mathematics and science educators, and researchers worked for three days to identify a set of 11 elements for analyzing state curriculum frameworks. The elements, outlined as follows, represent the panel's collective position on the characteristics and qualities they would look for in a state framework. The elements were the result of panel discussion of quality in frameworks, review of current state frameworks, and consideration of national standards in mathematics and science.

Status of the Framework in the State

- Is the framework a stand-alone document or is it dependent on other documents?
- Is the framework being developed or is it complete?

Vision of Science and Mathematics Education in the State

- How is the vision of science and mathematics education presented?
- What is the rationale for change?
- What version of the change process is articulated in the document?
- What are the origins of the ideas behind the vision?

Function and Intent of the Curriculum Framework

- What is the intent of the document? Who are the audiences of the document?
- Who (what groups) initiated development of the document?
- Who was involved in the development of the document?
- What is the document expected to accomplish?

Approach of the Framework as a Policy Statement

- What features of the document are designed to enable teachers and schools to make improvements in mathematics and/or science education?
- What features of the document rely on constraints or restrictions on teachers and schools to make improvements in mathematics and/or science education?
- What decisions are left to the local level? District level? School level?

- Characterize the nature of the approach of the document (persuasive, explicate, exhortative, etc.).

Conception of the Curriculum

- How does the document describe the discipline's importance, development, and future?
- What is the document's curricular emphasis and explicit instructional strategies?
- How does the document make connections to other disciplines and the real world?

Content of Mathematics and Science Curriculum

- Does the document reflect national discipline standards? (Which ones?)
- What are the major categories or topics unique to the state? How are the discipline's boundaries drawn?
- How is the curriculum organized (strands, themes, big ideas, etc.)?
- What is the breadth and depth of the subject matter?
- How is content integrated across disciplines?
- How are performance standards or expectations communicated in the document?
- How consistent are the principles with the examples in the documents?

Presentation and Communication of the Content

- How does the document communicate its content to its audience? (Does it use exemplars? Does it rely on other documents?)
- How readable is the document? Is it appropriate for its audience?
- Are any factual errors in evidence?

Pedagogy

- What conception of learning is presented in the document?
- What conception of teaching is presented?
- How are the conceptions of learning and teaching linked and aligned?
- How are assessment and instruction linked?

Equity

- How is equity presented in the document?
- How are grouping and tracking dealt with?

- What attention is paid to the needs of traditionally undeserved, underachieving, or special needs groups?
- To what extent are equity issues infused throughout the document?

Enabling Conditions

- How does the document address the school resources and organization necessary for improved achievement in mathematics and science education (materials, time, professional development, decision-making process)?
- How does the document address the necessary school district resources and community resources?
- What does the document say about the necessary family resources?

Policy Connections/Linkages

- What policy changes does the document suggest are needed? Teacher development? Assessment? Books and materials selection? Teacher preparation and certification?
- How is the curriculum framework linked to existing policies on teacher development, assessment, materials, teacher preparation, and teacher certification?

QUESTIONS FOR A QUALITATIVE ANALYSIS OF STATE FRAMEWORKS IN MATHEMATICS AND SCIENCE

Please prepare answers (or notes) on computer disc to the following questions after carefully reading the curriculum framework to be analyzed.

State Context (to be completed by staff)

1. Is the framework a stand-alone document or is it dependent on other documents?

2. Is the framework in draft form or is it complete?

3. Briefly describe the document. How is the document organized?

4. Briefly describe the development process. How was the document produced? Who was involved in the document's development?

5. Briefly describe the state's efforts to implement the framework. Identify the document's audiences. What is the document expected to accomplish?

6. How is the framework's vision statement articulated? What are the origins of the ideas behind the vision? What is the rationale for change and how does the state envision change occurring?

Content of Mathematics/Science in the Framework

1. Does the framework reflect the national discipline standards?

2. How does the framework deviate from the main ideas of the national standards? What is not included? What is added?

3. How consistent are the principles for content with the examples (e.g., vignettes, instructional strategies, sample problems) in the document?

4. Does the framework provide performance standards? Are they consistent with the national performance standards in mathematics and science? What other standards does the document address (assessment standards, teacher preparation, teacher professional development, program standards, system standards)? How well aligned are these standards with the national standards?

5. How are equity issues dealt with in the framework? How well integrated are equity issues in the document and in the examples? How are grouping and tracking dealt with?

Pedagogy and Presentation

1. What conceptions of learning, and of teaching, are presented in the framework? Is the pedagogy linked to content? Is it linked to the national content standards?

2. What features of the document are likely to assist teachers and schools make improvements in the teaching of mathematics and science? (e.g., readability, depth of explanation, use of exemplars, vignettes, sample lessons)

3. How well does the document make linkages between the disciplines? If the document advocates integration of the disciplines, how well does it maintain the rigor and integrity of the disciplines?

Enabling Conditions and Policy Linkages

1. Does the framework make a clear linkage between its vision and the policy changes necessary to realize the vision? What policy changes does the document suggest have already occurred to support the framework's vision and what additional changes are recommended?

2. How does the document deal with existing state curricular guidance?

3. How does the document address the necessary school, community, and family resources for improved achievement in mathematics and science?

Appendix C

State Examples

From *New Jersey Mathematics Curriculum Framework - Preliminary Version* (January 1995)

Short-circuiting Trenton	*The students:*
Ms. Ramirez announces to her seventh grade class that in three weeks they will make a journey to Trenton, the capital of New Jersey. They will be visiting eight sites - the Capitol, the New Jersey Museum, the War Memorial, the Old Graveyard, Trent House, the Old Barracks Museum, the Firehouse, and the Pedestrian Mall. To ensure that they spend as much time at the site as possible, and do as little walking as possible, the class must find the most efficient walking tour for the trip, starting and ending at the parking lot.	*apply mathematical skills to solve a real-world problem.*
The first problem that the students must address is finding the walking distance between each pair of sites. Ms. Ramirez supplies each team with a street map and a ruler; the maps identify all the sites to be visited and the routes joining them. She assigns each group the task of finding the distances between one site and all the others. This turns out to be an interesting task, since different groups interpret it differently. Some groups, for example, measure the straight line distance between two sites forgetting that buildings or ponds might render that walk impossible. How to measure the walking distance thus becomes an important topic of discussion, as does the question of appropriate units. These questions are eventually settled and the teachers uses the students' measurements to write a matrix which indicates the walking distance between any two of the eight sites; different groups occasionally have obtained different numbers, but after discussion, they have arrived at a common answer.	*use cooperative group work to generate problem-solving strategies* *freely exchange ideas and participate in discussions requiring higher-order thinking.* *collect and organize data needed to solve the problem.*
Ms. Ramirez selects a sample route for the walking tour and through discussion with the class explains how the total length of the walking tour is obtained from the matrix of information that the students generated — you find the distances between consecutive sites on the tour, and then add up the walking distances along the tour. She now asks her students to work in groups to decide on a strategy that they think will produce an efficient route (which starts and ends at the parking lot), and to assist the group's recorder in writing a short paragraph explaining their strategy. Some groups decide to list all possible routes and calculate how long a walk each route entails. (Ms. Ramirez asks the students how many possible routes do they think they will have to list.) Other groups suggest that the best	*recognize that there are numerous ways to solve the problem.* *work in cooperative groups to develop alternative strategies.*

route is obtained by always going to the nearest site.

Ms. Ramirez now asks the students to use calculators to carry out their strategy and determine the travel time for the routes they will be considering. After each group presents its results, the class will together compare the various methods that were proposed and the accompanying results. Among the questions which Ms. Ramirez will ask are: "Do the various methods give the same result?", "Which methods result in a most efficient route?", "What other strategies could we have used?" Responses from the students might include: "always use the shortest distance", "never use the longest distance", "put distances in increasing order and use only those that neither make a loop or put a third edge into a vertex", "Which method might we use if we have ten attractions to visit?"

The students:

compare the variety of strategies proposed.

PERFORMANCE INDICATORS

Through the investigation of meaningful problems, individually or in cooperative groups while using appropriate technology,

all students in grades 6-8, building upon the K-5 expectations, **will be able to:**

8.60 identify, describe, compare and classify two and three dimensional figures;
8.61 use a compass and straight edge as tools for basic geometric constructions;
8.62 investigate and discover geometric relationships through the use of manipulatives, constructions and computer graphic software;
8.63 create models of nets of three dimensional figures such as a cube, rectangular prism, cylinder and square pyramid;
8.64 visualize and draw orthographic projections;
8.65 discover and apply geometric properties and relationships such as congruence, similarity, parallelism, perpendicularity and symmetry;
8.66 apply geometric properties and relationships to make conjectures.

LEARNING EVENTS

These illustrate ways students develop an understanding of spatial sense and geometry.

In grades 6-8:

1. Construct a building from cubes and trade places with a partner. Use graph paper to draw and label the base, front and side of your partner's building. Then sketch the building on isometric dot paper.

2. In cooperative learning groups, construct a variety of polyhedrons and a table of values for the number of faces, number of edges, and the number of vertices. Search for relationships and make a conjecture using inductive reasoning. Write an algebraic equation to generalize the relationship between the number of faces, edges, and vertices for any polyhedron. Now, search for other relationships among the variable quantities. [Euler's Theorem: F + V - 2 = E]

3. Working with a partner, students will use a drawing and measuring software package, such as the Geometric Supposer to investigate properties and attributes of triangles and quadrilaterals. Students should gather and organize data to make conjectures about angle measurements, length of sides and diagonal relationships. What would happen if we divided a pair of adjacent sides of a triangle into 2 equal parts and joined the points with a line segment? Measure the sides, angles, perimeters and areas and then formulate conjectures. Test conjectures by repeating your construction with different triangles.

4. Using a reflective tool, such as a MIRA, investigate how to bisect a line segment and an angle. Using different triangles, construct perpendicular bisectors of the sides, medians, angle bisectors, and altitudes and discover their concurrencies.

5. Have students collect different styles of architecture from pictures in magazines, postcards, photos, or sketches. Being as specific and accurate as possible, students should identify all the geometric figures and relationships they see in each building.

6. Do all quadrilaterals tessellate? Explain and justify your answer. This can be extended to other polygons.

7. How many different rectangular prisms can be built using 24 cubes each with edge 1 cm. What are the dimensions of the rectangular prism with the largest surface area; the smallest surface area?

8. Make any polygon on a coordinate grid. The figure should be entirely in one quadrant. Pass the grid to a partner who must make a table of the coordinates of the vertices and then perform a reflection of the figure across the y-axis. The grid is returned to the first student who makes a table of the coordinates of the vertices of the image. How do these coordinates compare to those of the original figure? The first student then performs a reflection of the image across the x-axis. How do the new coordinates compare to those of the original figure? Give a rule in verbal or symbolic form for your observations. (This can be extended by rotating the original figure 90° or 180° about the origin.)

Fourth Grade
Performance Standards

STRAND 1: THE NATURE OF MATTER

A. Properties of Common Solids, Liquids and Gases

The student will know that common materials (e.g., water) can be changed from one state to another by heating and cooling.

STRAND 2: ENERGY

A. Energy Exists in Many Forms

The student will:

1. Recognize various forms of energy (e.g., heat, light and electricity).
2. Recognize how to trace the flow of energy in a system (e.g., as in an ecosystem)

B. Objects Store Energy

The student will identify stored energy sources.

C. Uses of Electrical Energy

The student will recognize different ways in which electrical energy is used.

STRAND 3: FORCE AND MOTION

A. Simple Machines Applications

The student will:

1. Recognize forces of gravity, magnetism and electricity operate simple machines.
2. Experiment with forces and communicate the effects of forces on objects.

B. Effects of Mass on Motion

The student will demonstrate that the more massive an object is, the less effect a given force has on that object.

STRAND 4: PROCESSES THAT SHAPE EARTH

A. Features of Earth's Surface

The student will:

1. Recognize that 75 % of the surface of the Earth is covered by water.
2. Communicate that the Earth has layers composed of various materials.
3. Describe the processes involved in the movement of the Earth's crust.
4. Investigate the effects of water, sun and atmosphere on the Earth's surface.

B. Water Cycle

The student will:

1. Explain physical properties of water.
2. Identify how the amount and type of water in an environment affect the adaptations of living things.

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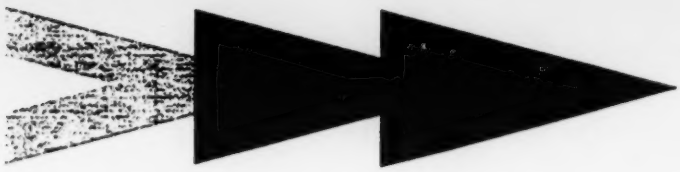

STRAND 5: EARTH IN SPACE

A. Components of Solar System

The student will:

1. Describe and compare the components of the solar system.
2. Recognize that the planets differ in size, characteristics, and composition and that they orbit the sun in our solar system.

B. Sun as a Star

The student will:

1. State the arrangement of planets in our solar system.
2. Recognize that, in addition to the sun, there are many other stars that are still farther away.

STRAND 6 PROCESSES OF LIFE

A. Cycles of Life

The student will observe the various stages of development of different organisms.

B. Human Body System Identification

The student will:

1. Recognize that the human body is made of systems with functions that are related.
2. Explain how bones and muscles work together to allow for body movement.
3. Explain how foods help the body.
4. Explain how foods help the body.

C. Living Things are Made of Cells

The student will recognize that similar cells form different structures.

STRAND 7 HOW LIVING THINGS INTERACT WITH THEIR ENVIRONMENT

A. Ecosystems

The student will:

1. Describe how the earth's air, water and soil support varied life forms.
2. Recognize that living things compete in a climatic region with other living things and that structural adaptations make them fit for an environment.
3. Explore and discuss the characteristics of a diverse ecosystem (such as a rain forest)
4. Describe characteristics that enable plants and animals to survive in various habitats.

B. Interactions Among Plants and Animals

The student will:

1. Recognize that animals eat plants or other animals to acquire the energy needed for survival.
2. Demonstrate the energy flow (food web, energy pyramid) in each ecosystem.

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STRAND 8 NATURE OF SCIENCE

A. Observe

The student will utilize appropriate observation skills in science activities.

B. Classify

The student will develop and use various scientific classification systems.

C. Measure

The student will:

1. Utilize the SI measurement.
2. Choose the appropriate unit for measurement for an activity.

D. Collect/Record Data

The student will:

1. Collect scientific data from activities.
2. Record data in an appropriate format.

E. Question

The student will formulate appropriate questions based on activities.

F. Identify Variables

The student will identify variables within a scientific activity.

G. Interpret Data

The student will interpret data collected through scientific experimentation.

H. Predict

The student will use prior knowledge and collected data to determine the outcome of an activity.

I. Draw Conclusions

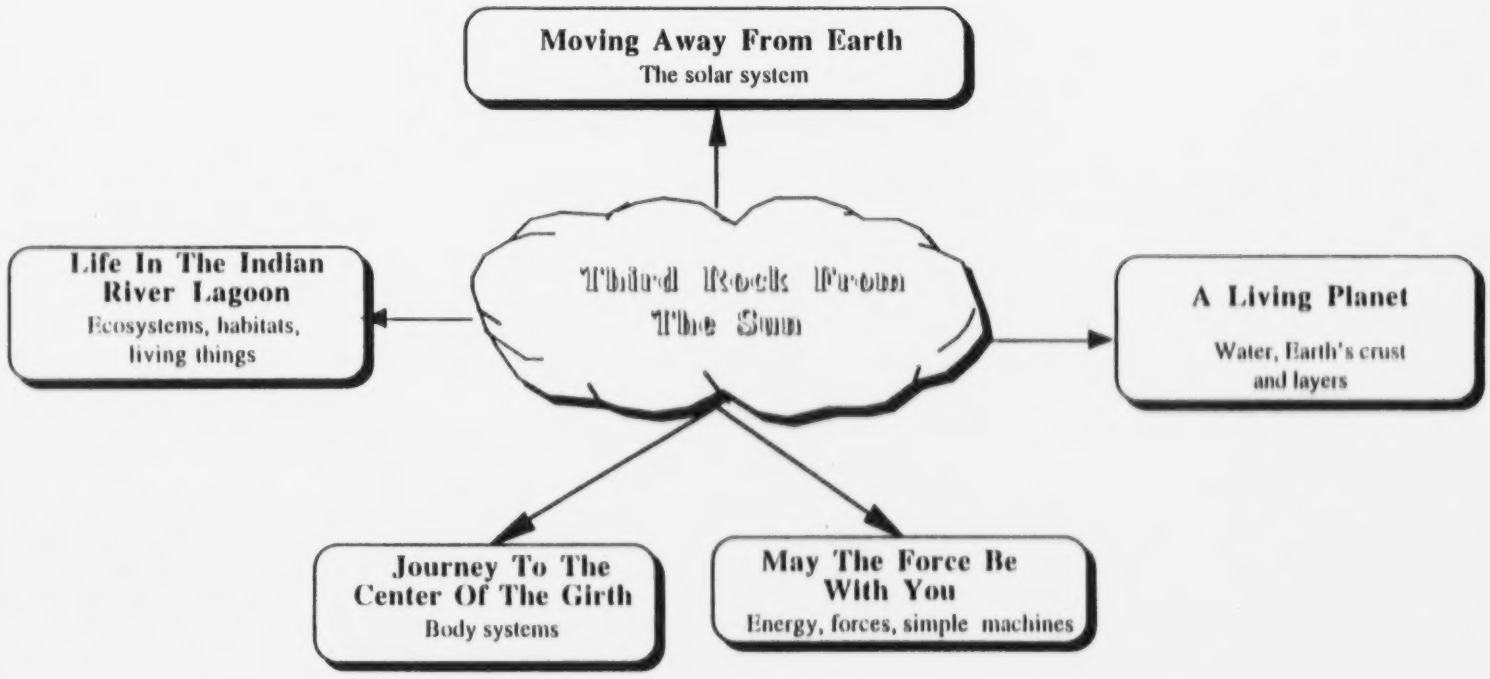
The student will draw conclusions based upon collected data.

J. Follow Safety Procedures

The student will apply proper safety procedures to scientific activities.

K. Use Science Equipment

The student will select and use appropriate equipment for scientific activities.


Moving Away From Earth
The solar system
Life In The Indian River Lagoon
Ecosystems, habitats, living things
Third Rock From The Sun
A Living Planet
Water, Earth's crust and layers
Journey To The Center Of The Girth
Body systems
May The Force Be With You
Energy, forces, simple machines

Fourth Grade Science

Sample Graphic Organizer

Fourth Grade

Third Rock From The Sun

Journey to the Center of the Girth

STATE STANDARDS SC.C.1.2.1, SC.G.1.2.5

3.1 3.2 3.4 3.7 3.8

PERFORMANCE STANDARDS 6B1-3, 7B1, 8A-B, 8G, 8J8

PURPOSE

- To recognize that the human body is made up of systems with functions that are related.
- To explain how bones and muscles work together to allow for body movement.
- To recognize that animals eat plants or other animals to acquire energy needed for survival.
- To recognize that similar cells form different structures.
- To explain how food helps the body.

MATERIALS

Butcher paper, art supplies, macaroni, skeleton model, microscope, construction paper

STRATEGIES

- Use a microscope to examine various types of cells.
- Draw and label the different types of cells examined.
- Brainstorm a list of energy sources for the body.
- Create a "Food Helps The Body" book.
- Cooperative groups trace and cut out body. Each group will "build" a selected/assigned system and glue it to the body shape. Groups will label system components and report to the class on system function and how the system interacts with other systems.
- Play a game matching body organs to the system they belong to.
- Use a skeleton model to show how bones and muscle work together.
- Create a skeleton using macaroni for bones and red yarn for muscles. Glue on construction paper.

ASSESSMENT

Student participation in activities
Student products rubric

RESOURCES

Moving Heavy Things by Jan Atkin (Houghton Mifflin)
The Magic School Bus by Joanna Cole, (Scholastic)

CONNECTIONS

Art (body model)

Fourth Grade

Third Rock from the Sun

Moving Away From Earth

STATE STANDARDS SC.E.1.2.4, SC.E.1.2.5, SC.E.2.2.1

3.2 3.3 3.4 3.6 3.8

PERFORMANCE STANDARDS 5A1-2, 3B, 5B1-2, 8A, 8B, 8E, 8G

PURPOSE

- To describe and compare the components of the solar system.
- To state the arrangement of planets in our solar system.
- To recognize that the planets differ in size, characteristics, and composition and that they orbit around the sun.
- To recognize that in addition to the sun, there are many other stars that are still farther away.

MATERIALS

Art supplies, measuring devices, graph paper, science journals

STRATEGIES

- Take a field trip to B.C. C. Planetarium. Reflect on experiences in journal.
- Arrange planets in order across the length of a hallway or classroom. Discuss relative size an distance and why a true scale model is difficult to build.
- Desing and participate in a body movement activity that simulates planets rotating and revolving around the sun.
- Graph planets according to a selected characteristic.

ASSESSMENT

Teacher observation
Student participation in activities
Rubric

RESOURCES

Discover The Wonder, Module A (Scott Foresman Science)
The Magic School Bus , "Lost in The Solar System", by Joanna Cole (Scholastic)
Voyager: An Adventure Through Space, by John Gustafson (Scholastic)

CONNECTIONS

Art (model solar system), Math (measurement, graphing), Language Arts (journal writing)

Fourth Grade

Third Rock From The Sun

A Living Planet

STATE STANDARDS SC.D.1.2.4

3.2 3.3 3.4 3.8

PERFORMANCE STANDARDS 1A, 4A2-4, 8A-E, 8G-K

PURPOSE

- To communicate that the Earth has layers composed of various materials.
- To describe the processes involved in the movement of the Earth's crust.
- To investigate the effects of water, sun, and atmosphere on the Earth's surface.

MATERIALS

Art supplies, ice cream, ice cream cones

STRATEGIES

- Cooperative groups will research and design a demonstration of the effects of water, sun, or atmosphere on the Earth's surface.
- Create layers of the Earth out of different colors of ice cream and ice cream cones. Discuss layers of earth as you eat the ice cream.
- Design a demonstration of the movement of the Earth's crust.

ASSESSMENT

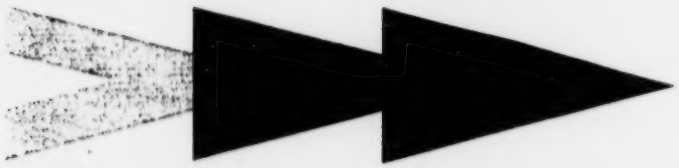
Rubric

RESOURCES

Discover the Wonder, Module B, (Scott Foresman Science)
The Magic School Bus : Inside the Earth by Joanna Cole, (Scholastic)

CONNECTIONS

Art (paper mache), Math (graphing, measuring), Language Arts (writing))



Fourth Grade

Third Rock from the Sun

May The Force Be With You

STATE STANDARDS SC.c.2.2.1, SC.C.2.2.3

3.2 3.3 3.7 3.9

PERFORMANCE STANDARDS 5A1, 2B, 2C, 3A1-2, 3B

PURPOSE

- To recognize various forms of energy and identify stored sources of energy.
- To recognize different ways in which electrical energy is used.
- To recognize that forces of gravity, magnetism, and electricity operate simple machines. Experiment with forces on objects.
- To demonstrate that the more massive an object is, the less effect a given force has on that object.

MATERIALS

Art supplies, chart paper, booklet, simple machines

STRATEGIES

- Brainstorm a list of electrical energy and other energy uses at home and school.
- Create a booklet describing ways to reduce the amount of electrical energy used at home and school.
- Create a graph of stored energy sources.
- Set up experiments using gravity, magnetism, and electricity on simple machines. Record results.
- Set up experiments to show that the more massive an object is, the less effect a given force has on that object.

ASSESSMENT

Teacher observation
Self assessment

RESOURCES

Machines by Janice Van Cleave (John Wiley and Sons, Inc.)

CONNECTIONS

Language Arts (booklet)

Fourth Grade

Third Rock From The Sun

The Indian River Lagoon

STATE STANDARDS SC.B.1.2.1, SC.D.1.2.2, SC.D.1.2.3, SC.F.1.2.2, SC.F.1.2.3, SC.G.1.2.2
3.1 3.2 3.4 3.5 3.8

PERFORMANCE STANDARDS 4A1, 4B1-2, 6A, 7A1-4, 7B2, 8A-B, 8D-E, 8G, 8I

PURPOSE

- To observe various stages of development of different organisms.
- To describe how air, water, and soil support varied life forms.
- To describe the characteristics of a diverse ecosystem and demonstrate the energy flow.
- To recognize that living things make structural adaptations.
- To describe characteristics that enable plants and animals to survive in various habitats.
- To identify how the amount and type of water in an environment affect the adaptations of living things
- To explain the properties of water and recognize that 75% of the Earth's surface is covered with water.

MATERIALS

Art supplies, science journals, chart paper, lagoon habitat components

STRATEGIES

- Take regular field trips to the Indian River Lagoon. Record observations in science journal.
- Make a chart of organisms found in the air, water, and soil at the lagoon.
- Discuss the habitats that support the plants and animals in the lagoon.
- Design, set up, and maintain a lagoon habitat in the classroom, including plants and animals. Observe and record daily observations.
- Observe organisms for competition with other living things and for structural adaptations.
- Invite a guest speaker to discuss the lagoon and create a mural of lagoon habitats.
- Create a paper mache globe showing that 75% of the Earth's surface is covered with water.

ASSESSMENT

Student participation in activities. Student products.

RESOURCES

Diving into Science by Peggy K. Perdue (A Good Year Book)
The Indian River Lagoon: An Exceptional Lagoon, Florida Dept. of Natural Resources
Protecting Paradise: 300 Ways to Protect Florida's Environment by P Cavanaugh & M. Spontak (Phoenix Publishing)
A Walk In The Wild : Exploring a Wildlife Refuge by L. Ward and L. Jacques (Charlesbridge)

CONNECTIONS

Art (mural), Language Arts (journal)

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